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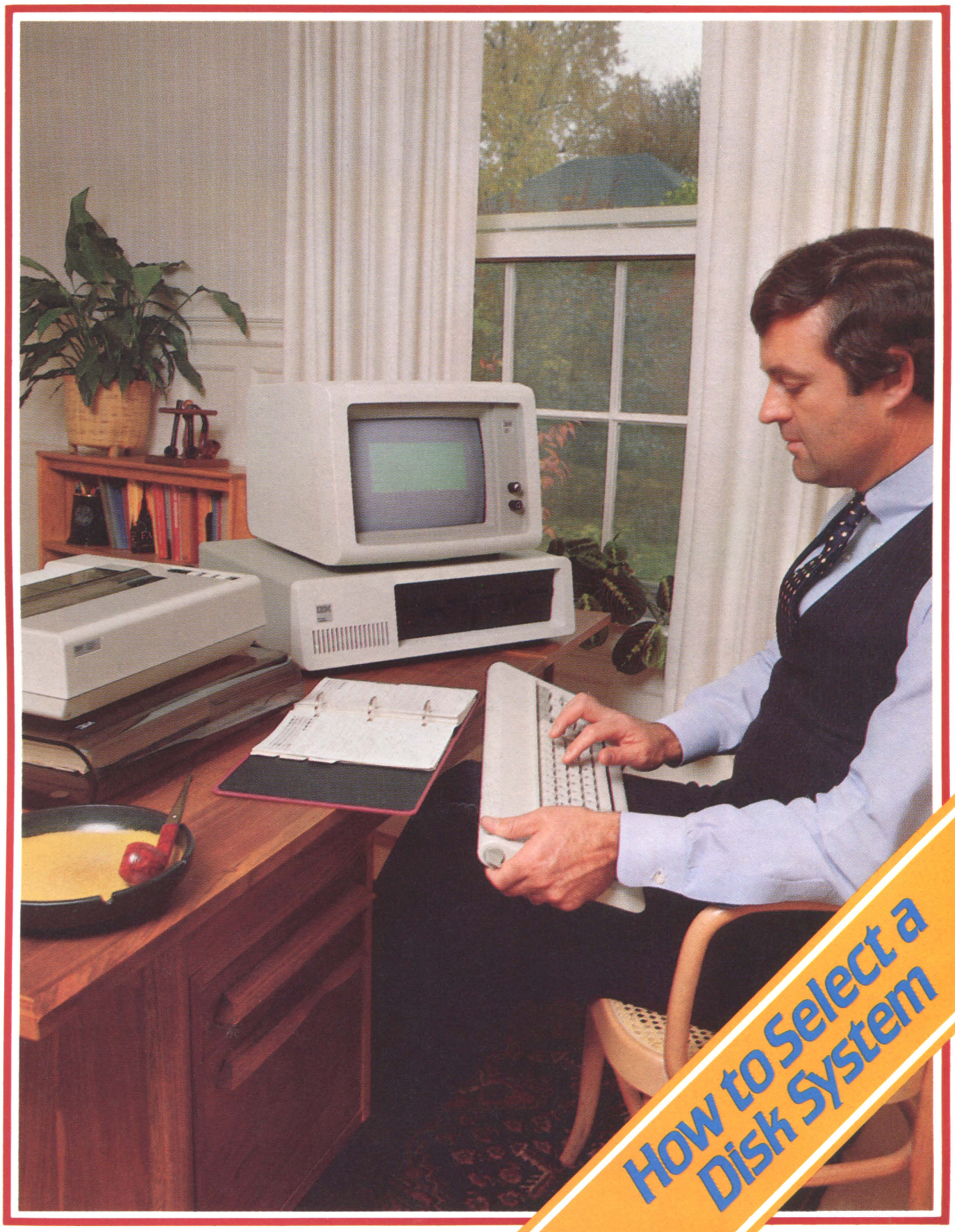

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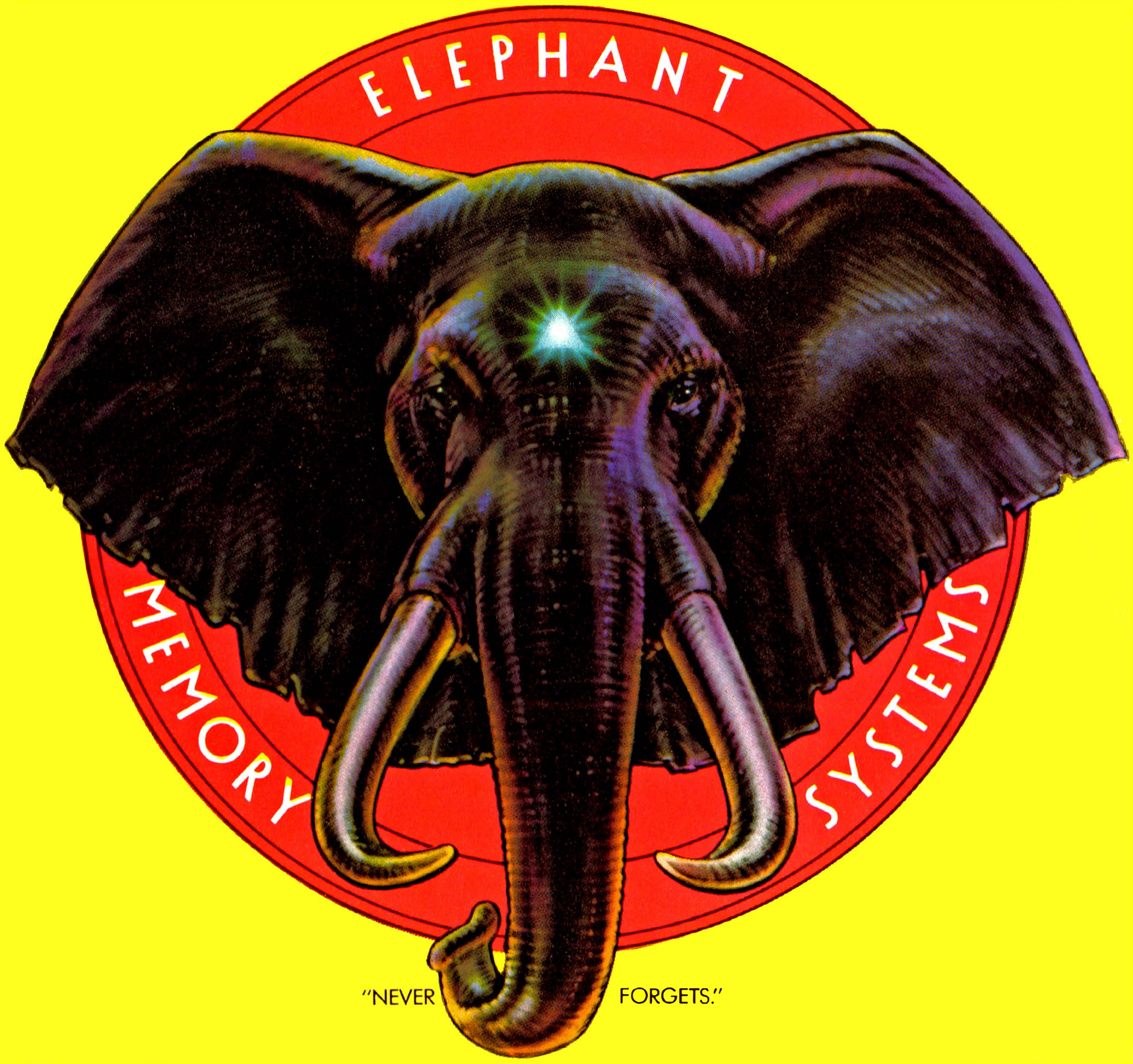

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Vol. 1, No. 5 March 1982

Popular Computing was previously published as the quarterly *onComputing*.

Features

24

The IBM Personal Computer

By George Stewart
An in-depth review of what our technical editor believes is the definitive personal computer.

38

The Radio Shack TRS-80 Pocket Computer

By Theresa Welsh
Easy to transport and easy to use, this hand-held computer does things its big brothers can't.

47

Classroom Computers

By Joseph Bourque
The on-again/off-again computer education revolution is on-again in earnest.

52

Word Processing

By Peter McWilliams
Tips for choosing the ideal computer hardware for word processing.

56

Camping with Computers

By Heidi Copeland
Vacationing kids are cavorting to the tune of high-tech rec.

98

Self-Teaching BASIC for the Apple

By Robert Schilling
This instructional program will teach you BASIC in twelve lessons.

102

Photo by George Hall

Silicon Valley—The Wild West of Computer Technology

By A. Richard Immel
A look at California's microelectronics frontier.

110

A Beginner's Guide to BASIC Programming, Part 2

By Elizabeth Hughes
The conclusion of a straightforward BASIC tutorial.

120

Word

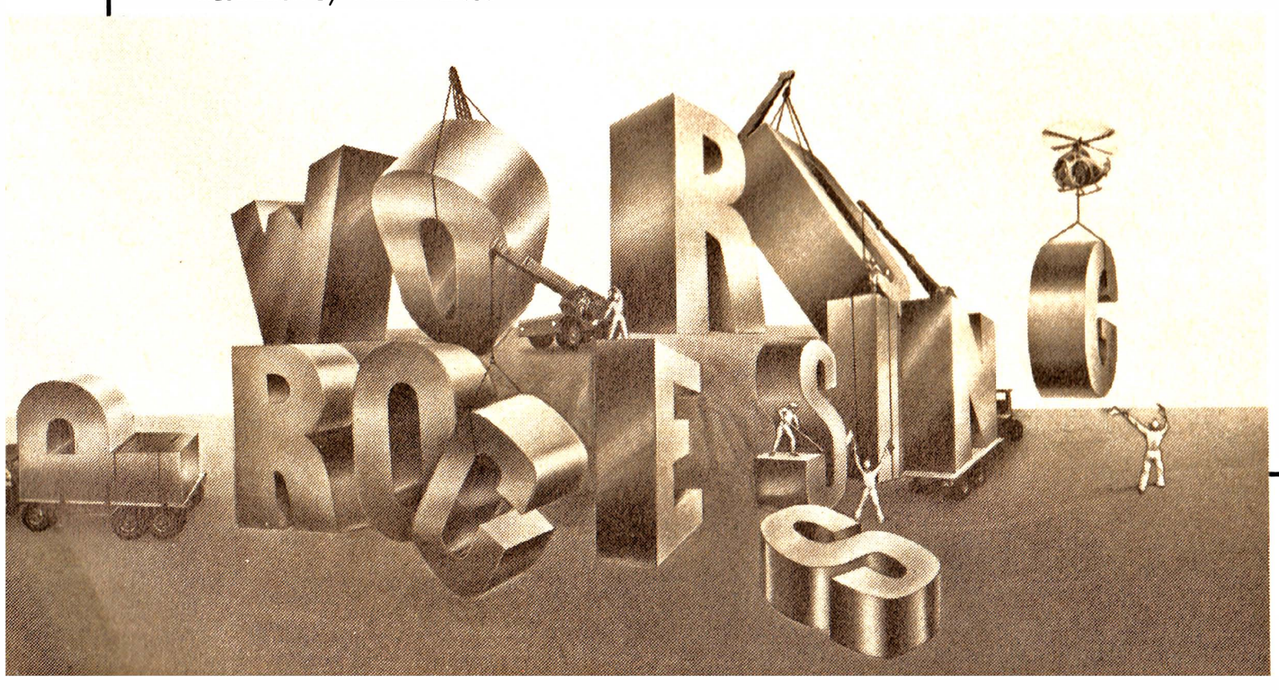
By Peter McWilliams
With this spelling correction program, misspelled words are a thing of the past.

122

The Voice

By Robert Swirsky
An inexpensive way to give your Apple a voice.

Illustration by William Giese



Departments

4 Popular's View
6 Ask Popular
11 Update
19 New Products
60 What Do You Do After You Plug It In?
70 Small-Business Computing
74 Telecomputing
80 My Computer Likes Me
112 Reader Service
124 Book Reviews
128 Coming Up

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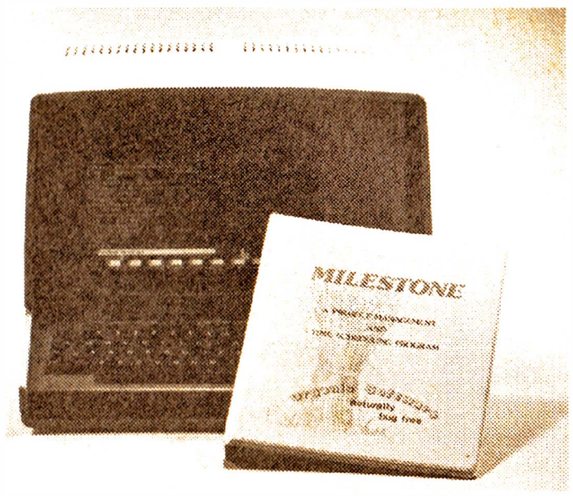

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Popular's View

The Future Is the Present

Stretching from San Francisco to San Jose, Silicon Valley is, electronically speaking, the fertile crescent of the west and the birthplace of the microcomputer. This month *Popular Computing* presents a portrait of this land of paradoxes (see "Silicon Valley—The Wild West of Computer Technology" by A. Richard Immel, page 102). In the early 1970s the valley spawned the most important electronic development of the decade: the Intel 4004. The first microprocessor "chip," the 4004 was the forerunner of today's sophisticated personal computers.

The carefully manicured lawns and low-slung buildings dotting the valley create a sense of peace and order that belies the frenzied activity within the corporate walls. A Disneyland for techno-freaks, Silicon Valley is filled with high spirits as well as high intensity. Insouciance, as Edmund White said, is a West Coast pose. In this land of alleged lotus eaters, an engineer can receive more than one job offer during lunch, and people may change jobs with the moon's phases.

Computer designers are often brilliant conversationalists. And most of their talk is about the future, because the rest of the world's future is Silicon Valley's present — in both senses of the word "present." Computer designers speak of tomorrow's computers with such fervor that you can almost put your fingers on the imagined keyboards and enter programs.

Years ago computer expert Allan Kay (then with Xerox, now with Atari) dreamed of a powerful, book-sized personal computer with staggering capabilities: millions of bytes of memory, a flat video screen, compact keyboard, and total portability. He called it the "Dynabook." Today Silicon Valley is coming tantalizingly close to creating that dream. Several companies are developing battery-operated, book-sized computers. The research, of course, goes on behind closed doors and paranoia runs high. Out of necessity, many of the designs will not be available for public consumption for several years. Nervous entrepreneurs cannot afford to see their dreams washed away by careless leaks.

It's a slightly mad world out there, a high-tech phenomenon that could have occurred only in California. Yet what happens in Silicon Valley ultimately affects us all. □

Chris Morgan
Editor in Chief

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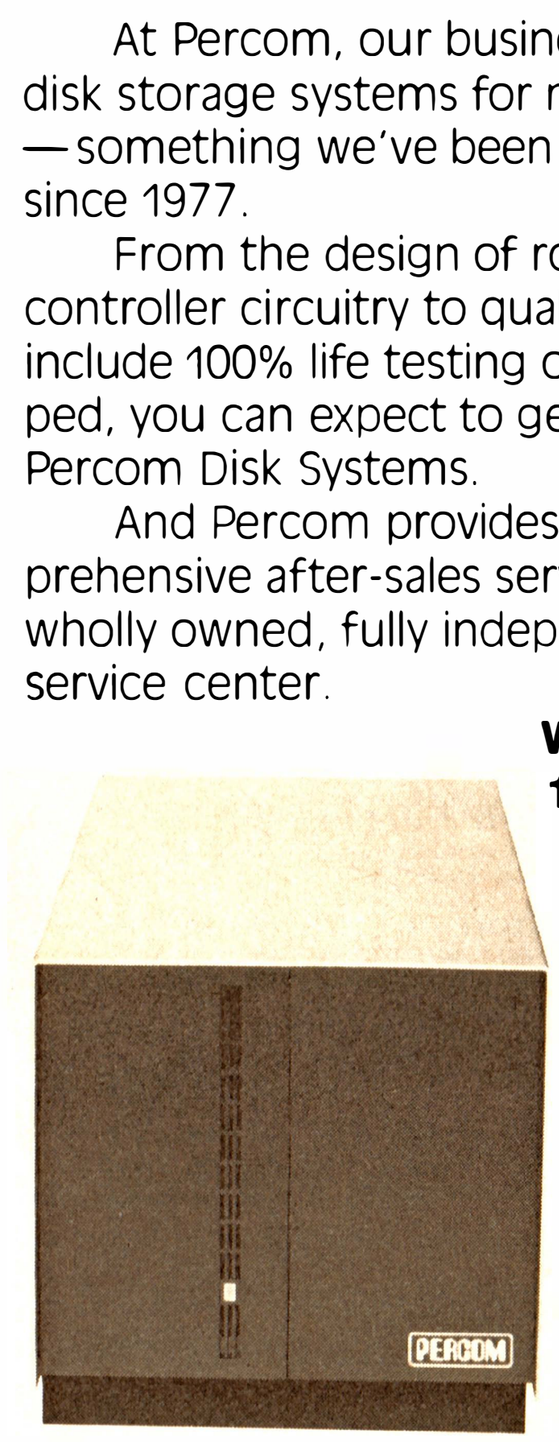

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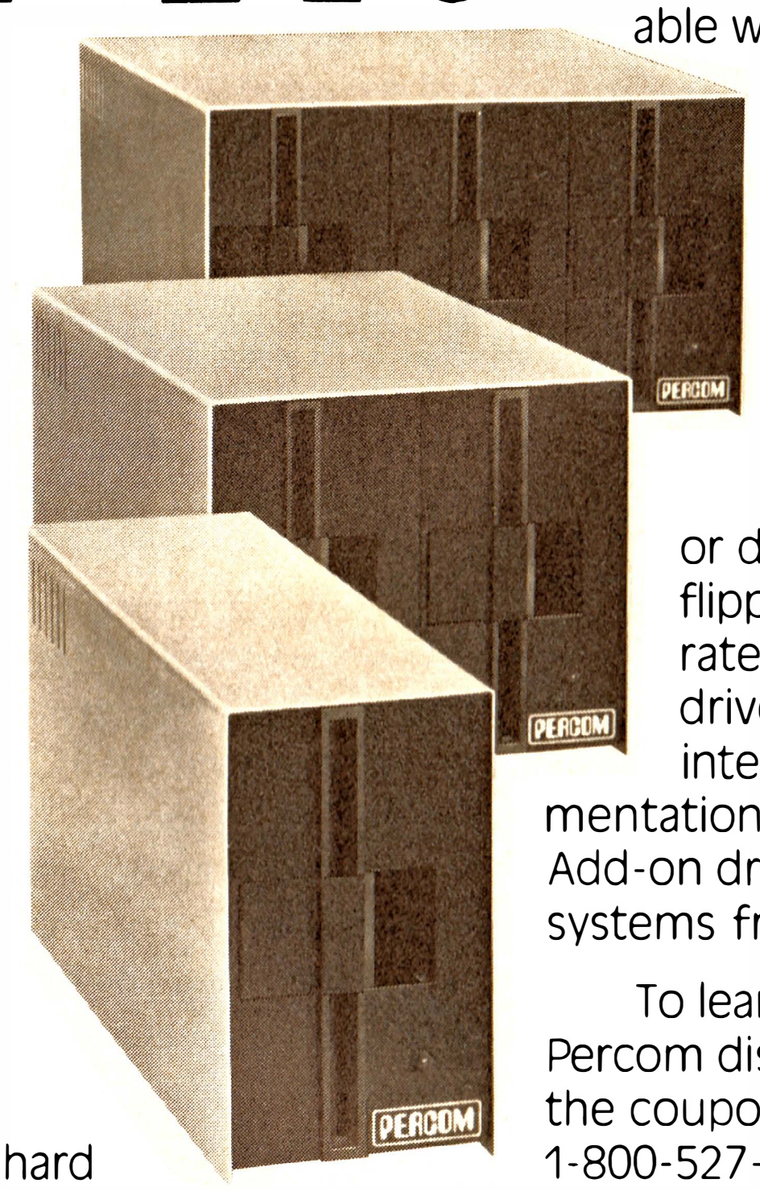

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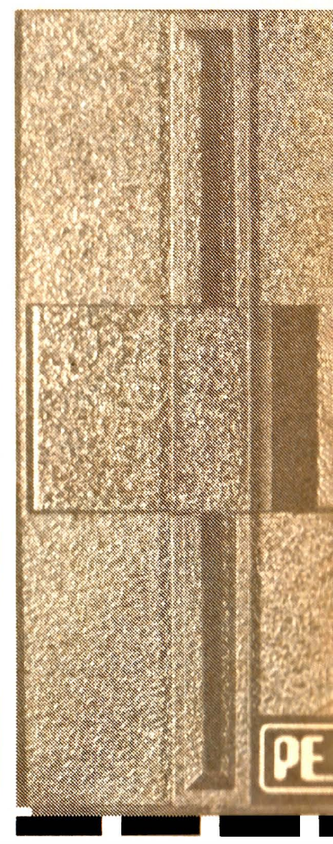

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Ask Popular

Ask Popular is a monthly column in which we answer general questions about small computers. Send your questions to: Ask Popular, POB 397, Hancock, NH 03449. (Due to the large number of letters received, we cannot answer each question with a personal letter.)

Q In your answer to the question, "What's a K?" you stated that 8 doesn't divide evenly into 1000. Using old-fashioned long division, I get 1000 / 8 = 125. Even my hand-held calculator agrees. I didn't try it on a computer, but suspect the answer would be the same. What gives?

A A lot of readers asked the same thing. Strange as it sounds, there was a logical train of thought leading up to that gross error. Let's try again. . .

"K" stands for "kilo," which usually means 1000. But not in the world of computers. Computers are *binary* machines: they form numbers using two symbols, usually represented as 0 and 1. Humans, on the other hand, rely on *decimal* arithmetic, using ten symbols, 0 through 9, to form all numbers. Just as humans find it convenient to deal with powers of 10 (100, 1000, 10,000, etc.), computers find it convenient to deal with powers of 2 (4, 8, 16, etc).

One thousand is a power of 10 (10^3), but it is *not* a power of 2. The power of 2 closest to 1000 is 1024 (2^{10}). For this reason, a computer "K" is 1024 instead of the decimal "K," which is 1000.

Now a question for you. If a decimal "M" (mega) is 1,000,000, what's a computer "M"?

Q What is an IEEE-488 interface? How is it different from an RS-232C?

A IEEE-488 is a specification created by the Institute of Electrical and Electronics Engineers that defines signal conventions for a *parallel interface* for communications between computers and other devices. Several bits of data are transmitted simultaneously along parallel lines. This relatively complex interface offers a variety of signal types and is thus useful for controlling laboratory instruments as well as for data communications. Commodore's PET and CBM computers include an IEEE-488 interface.

RS-232C is a specification of the Electronic Industries Association, describing signal conventions for a *serial interface*—in other words, one in which data bits are transmitted one at a time. This interface is simpler than the IEEE-488 and is widely used for data communications and I/O (input/output) operations such as printing and reading a light pen.

Q Can today's personal computers perform such "real-world" functions as monitoring house temperatures or turning air conditioners on and off?

A If you're willing to use additional hardware to isolate your computer's low-power circuits from the heavy-duty electrical demands of household devices, yes, personal computers can control all kinds of devices. It's often called *real-time process control*.

One available home-control system connects the computer to a control module (available from BSR, Inc.), which in turn switches remote modules by signals sent through the AC wiring.

Advantages of using a computer for real-world monitoring and control are many: the computer can take a great number of factors into account when deciding how to control a device (time of day, outside temperature, number of people in the house).

Furthermore, the computer can respond to changing conditions faster than other control devices such as thermostats.

There are a few drawbacks to using a personal computer for real-time control. For one thing, it probably means tying up your computer so that you can't use it for any other purpose. Another possible deterrent is lack of reliability in critical situations. Personal computers are not always designed for use in such applications as controlling a house air conditioner. Is a computer failure tolerable in the application you have in mind? Decide before you put your computer to the test.

Q I've been shopping around for dot-matrix printers, and I'm confused about the way they describe the character size in two dimensions, for example, 5 by 7. My question is 5 by 7 what?

A The unit of measurement is *dots*; the measurement tells you the *resolution* (the number of dots available for character formation) in each dimension. The horizontal resolution is always given first, then the vertical. (Math teachers probably don't like this, since matrices are usually specified in the reverse order.)

Q Where can I find out more about programming languages like APL, FORTH, and Pascal? Is it practical to try these on a personal computer?

A The languages you mentioned all have unique advantages over BASIC, and for anyone who enjoys programming (expert or not), they're worth investigating.

APL is widely available on microcomputers, especially CP/M-equipped systems. The "standard" Pascal,

Continued on page 10

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"My own IBM computer. Imagine that."

One nice thing about having your own IBM Personal Computer is that it's *yours*. For your business, your project, your department, your class, your family and, indeed, for yourself.

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- Unique one-touch entry of key words like PRINT, RUN and LIST
- Automatic syntax error detection and easy editing
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- Built-in interface for ZX Printer
- 1K of memory expandable to 16K

The ZX81 is also very convenient to use. It hooks up to any television set to produce a clear 32-column by 24-line display. And you can use a regular cassette recorder to store and recall programs by name.

*Plus shipping and handling. Price includes connectors for TV and cassette, AC adaptor, and FREE manual.

If you already own a ZX80

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With the 8K BASIC chip, your ZX80 will also be equipped to use the ZX Printer and Sinclair software.

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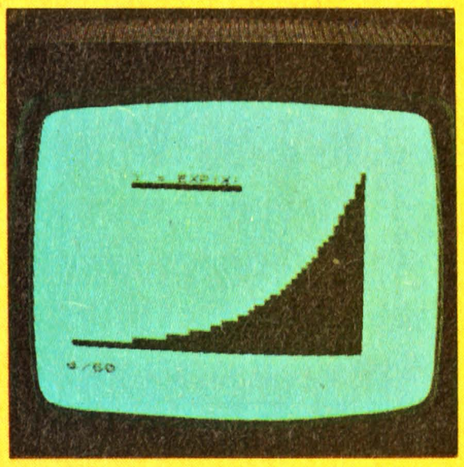
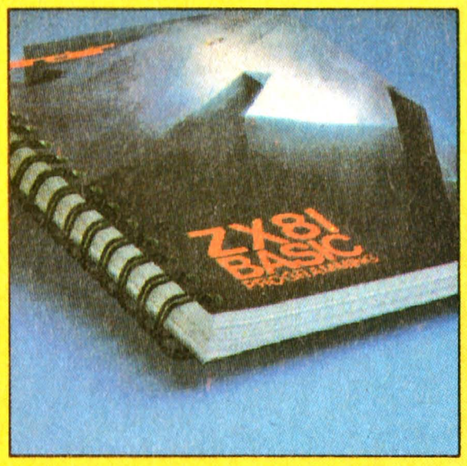
**Does not apply to ZX81 kits.



NEW SOFTWARE: Sinclair has published pre-recorded programs on cassettes for your ZX81, or ZX80 with 8K BASIC. We're constantly coming out with new programs, so we'll send you our latest software catalog with your computer.

ZX PRINTER: The Sinclair ZX Printer will work with your ZX81, or ZX80 with 8K BASIC. It will be available in the near future and will cost less than $100.

16K MEMORY MODULE: Like any powerful, full fledged computer, the ZX81 is expandable. Sinclair's 16K memory module plugs right onto the back of your ZX81 (or ZX80, with or without 8K BASIC). Cost is $99.95, plus shipping and handling.



ZX81 MANUAL: The ZX81 comes with a comprehensive 164-page programming guide and operating manual designed for both beginners and experienced computer users. A $10.95 value, it's yours free with the ZX81.

The $99.95 personal computer.

Introducing the ZX81 kit

If you really want to save money, and you enjoy building electronic kits, you can order the ZX81 in kit form for the incredible price of just $99.95.* It's the same, full-featured computer, only you put it together yourself. We'll send complete, easy-to-follow instructions on how you can assemble your ZX81 in just a few hours. All you have to supply is the soldering iron.

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Ask Popular

licensed from the University of California, San Diego, is available on Apple and TI computers and has been announced for the IBM Personal Computer. Smaller versions of the language are available for TRS-80s and other computers, and versions of FORTH are available for the Apple and TRS-80.

For names of vendors, contact your local computer users group or computer store. You can also find articles and advertisements in *Popular Computing*'s sister magazine, BYTE, available at computer stores.

Q My computer is equipped with a serial interface and a telephone modem. I want to contact Tymnet or Telenet, but I can't find listings for them in the local telephone book. How do I go about tying in to one of the information utilities?

A There's more to it than just obtaining a telephone number, and you wouldn't call Tymnet or Telenet directly because they are only the vehicles for the information.

First you must contact the sales office of one of the information utilities such as Compuserve or The Source. The people at the information utility will explain the costs and methods of signing up. Then you'll be given an ID number, password, and a list of telephone numbers that will put your computer online. If specialized software is recommended for using the service, they'll tell you how to obtain it. For most cities, a local call is all you'll need to go online.

Here are addresses for a few of the major information utilities:

- Compuserve
  5000 Arlington Centre Blvd.
  Columbus, OH 43220
- The Source
  1616 Anderson Rd.
  McLean, VA 22102
- Dow Jones News/Retrieval Service
  POB 300
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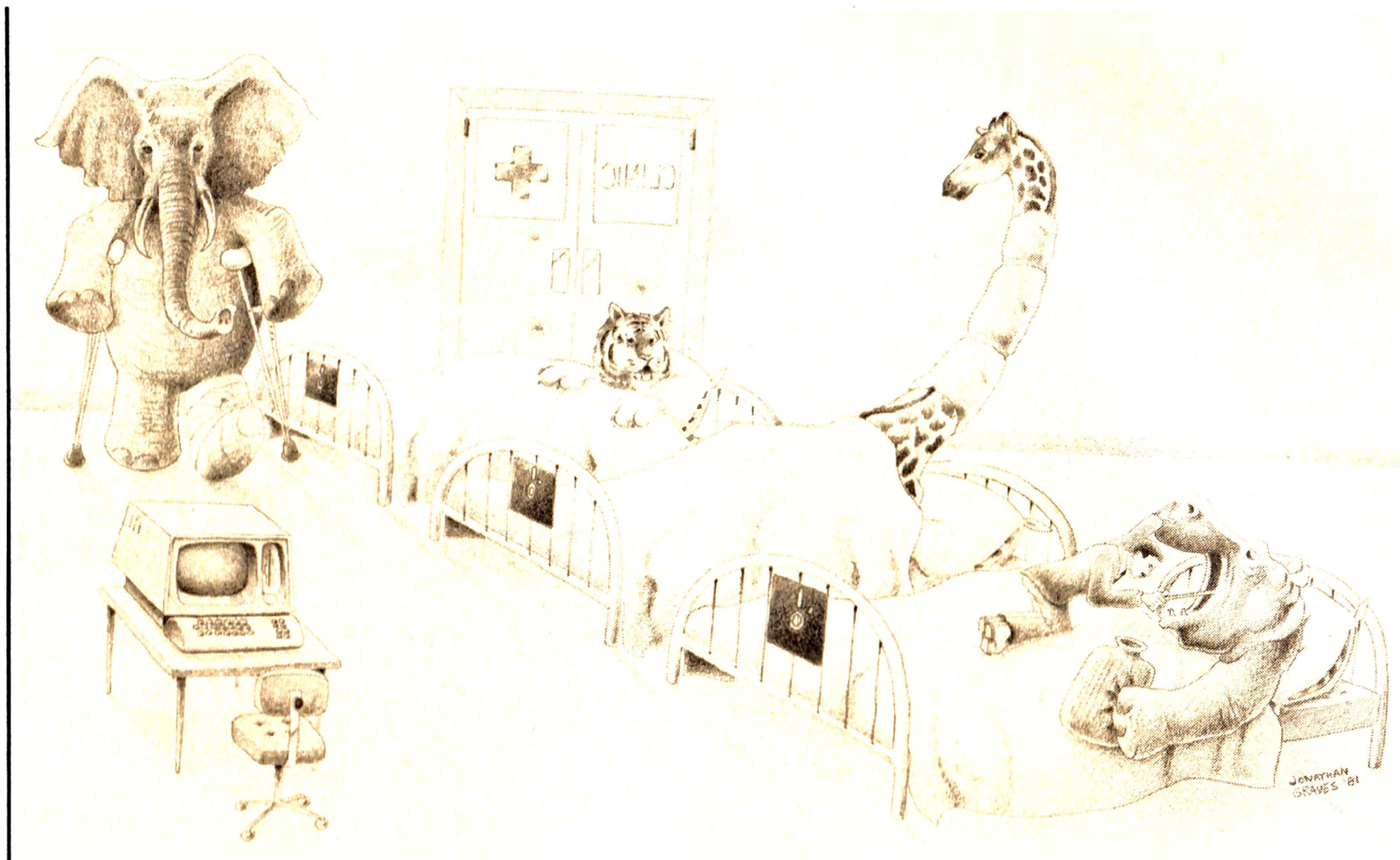
Circle 21 on inquiry card.

Update

Animal Health Care Outpaces Humans'



A dog's life is looking better and better. If present trends continue, within five years the organization and integration of your pet's health care may surpass that of your own.

San Francisco's Jeff Hardy, who specializes in methods of managing health information, notes that the animal-care community has moved swiftly toward computerization. Among the results are increased efficiency in maintaining individual records and in disseminating information among professionals.

"In human hospitals, records and information exchange are not very well integrated into the health-care system," says Hardy. "In contrast, animal-care facilities like those at the San Francisco Zoo have been planned from the start with ease of use, relevance, and information integration in mind." The computer system at the San Francisco Zoo plays an essential role in maintaining medical records and other information. Hardy believes the system has been readily accepted by the staff because it was specifically designed to meet the informational needs of the zoo's health-care professionals.

Veterinarians have the advantage of greater control over the format of the individual health record. They can design and maintain records without considering the informational needs of assorted specialists (there are few specializations in veterinary medicine).

In the human medical arena, time is money. As such, any time a physician devotes to learning about or implementing more efficient information management represents a considerable investment. Also, the two disciplines of information management and medical documentation are developing independently. Perhaps the better-integrated health-care systems evolving in veterinary medicine will inspire improved communications in human health care. After all, we can at least tell them where it hurts.

The Taxman Cometh to Computers

Did you somehow forget to report to the Internal Revenue Service interest earned on your savings account last year? You and thousands of other taxpayers may be hearing from an IRS watchdog computer soon.

Using a program initiated in 1975, IRS computers are currently matching 80 percent of all interest and dividend payment statements with 1040 forms. The computers, however, aren't tallying 100 percent of the information yet because many small banks are still sending in paper returns instead of computer tapes, and the IRS doesn't have enough employees to match the forms by hand.

According to the U.S. Treasury, the computer program is returning $4 to $5 for every $1 spent on the project by uncovering some $500 million worth of unpaid taxes. About 6 percent of all American taxpayers file erroneous information on dividend interest, the IRS reports. This year, the IRS expects to uncover another $800 million in unpaid taxes with the computer program and return $300 million to taxpayers who reported too much.

Now if only someone could write a computer program that would balance the federal budget.

Through Rain, Sleet, and Wires

Computers are officially playing mailman, according to the U.S. Postal Service.

The new electronic mail service E-Com is intended for companies sending large quantities of computer-generated letters, bills, or other documents. The letters are wired to the post offices equipped to receive them, printed, sealed in envelopes, and delivered to address as first class mail.

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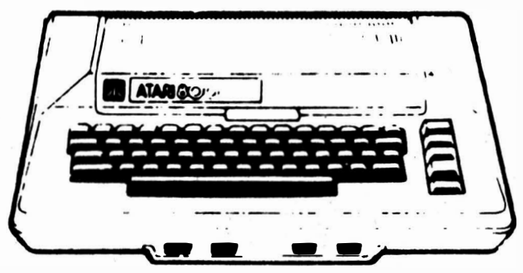

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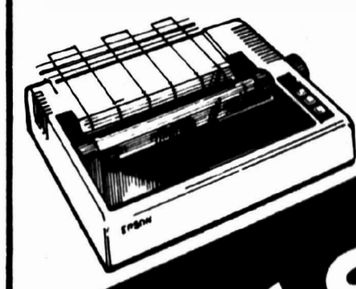

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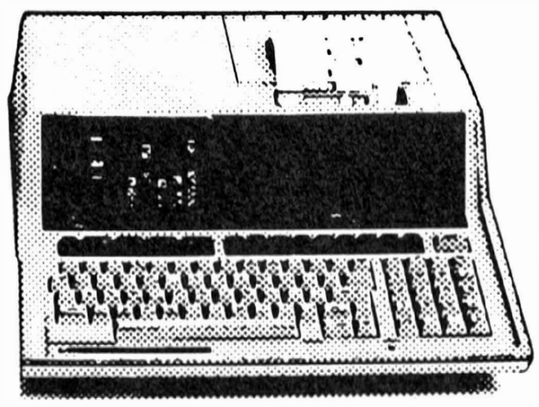

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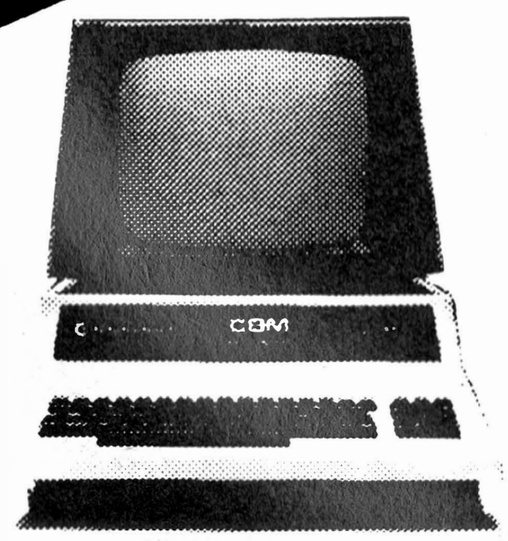

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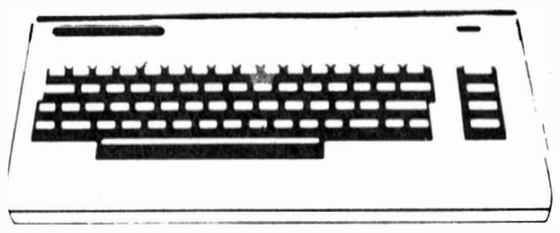

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Resusciannie Is No Dummy

There's a chance that cardiopulmonary resuscitation (CPR) training may become more widely practiced as the result of a computerized program. The American Heart Association in Dallas, Texas, has combined an Apple computer, a videodisk player, and a Resusciannie CPR dummy to create a fully animated, interactive CPR training program.

Resusciannie is a life-sized dummy equipped with a lifelike respiration system and the anatomical features necessary for learning proper CPR techniques. Widely used in existing CPR courses, Resusciannie has proved to be a valuable teaching aid.

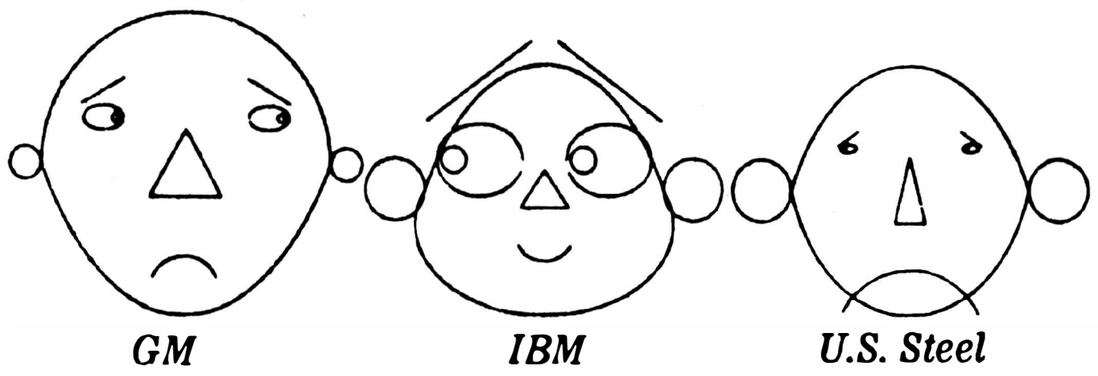
According to David Hahn, director of the project, human instructor time is eliminated. This allows a person to attain full CPR certification without ever having to consult anyone else. The system is not impersonal, however. By carefully monitoring your CPR technique on Resusciannie, the Apple computer selects one of over 700 coaching responses recorded on the video disk to provide you with the most appropriate visual and audio feedback. Best of all, the whole program can be completed at a time that's convenient to *you*, the student.

Initial results indicate that this program is much faster and more comprehensive than existing training, with full certification possible in fewer than three hours (four hours if four people train simultaneously). Even more important, refresher courses can be completed in a half hour or less, keeping your certification current with a minimum of inconvenience.

Students report that the training is fun, particularly when taken with a few friends. Loretta Powers of the American Heart Association describes the system as having infinite tolerance, repeating procedures until you get them right. "You can also skip problem areas until later," says Powers. "The system passes no judgment on your performance—it just keeps on teaching until you get it."

Even without the Apple II computer, Resusciannie gives feedback to the student on how well he or she is performing CPR. Much of the feedback, however, is presented on a strip chart recorder, requiring a trained instructor to interpret the results. The Apple II eliminates this phase by analyzing data from the Resusciannie, then presenting video images of an instructor showing how your CPR performance could be improved.

The Apple provides the student with more traditional coursework through video lectures on CPR background and theory. By testing the student continually and requiring instant responses, the program promotes comprehension, retention, and quick thinking in emergency situations. Hahn hopes to have the system widely available within the next six to twelve months.



Put on a Happy Face

The next time you see Lee Iacocca's smiling face, consider a data-management technique developed at MIT in the early seventies and currently under revision by three marketing professors. Computerized drawings of faces are used to convey complicated financial information such as the ratio of retained earnings to total assets, cash flow, return of assets, and the like. Financial information from a company's annual report is assigned to various facial features. The length of the eyebrow tells you how the firm's inventory turnover is doing, the diameter of the ear signifies the ratio of current assets to current liabilities, and the eyebrow angle represents cash turnover.

"It's fun and I think there's a lot of potential here," says one of the technique's investigators, Vijay Mahajan, marketing professor at the University of Pennsylvania's Wharton School. Mahajan, David Huff of the University of Texas, and William Black of the University of Arizona are experimenting with the technique in hopes it will be more revealing than numbers or charts.

The faces pictured here are supposed to reflect the respective firms' financial health as stated in recent annual reports. "IBM," says Mahajan "looks like the cat that swallowed the canary."

College to Offer Computer Art

California Institute of the Arts (Cal Arts), under the guidance of Provost Ed Emshwiller, is planning to offer computer graphics courses to undergraduate art students. Using Apple II computers and Atari 800s, Emshwiller hopes the students will experience some of the wonder and excitement he has felt in working with the technology.

"Computers are a very powerful, stimulating, creative tool for the artist," he says. "They enable you to make transformative images in new ways." Emshwiller is an internationally known artist. Before turning to film, video, and computers, he was an abstract expressionist painter and illustrator. His experimental films (*Relativity*, *Totem*, *Three Dancers*, and *Thanatopsis*) have been given awards and numerous screenings at film festivals around the world.

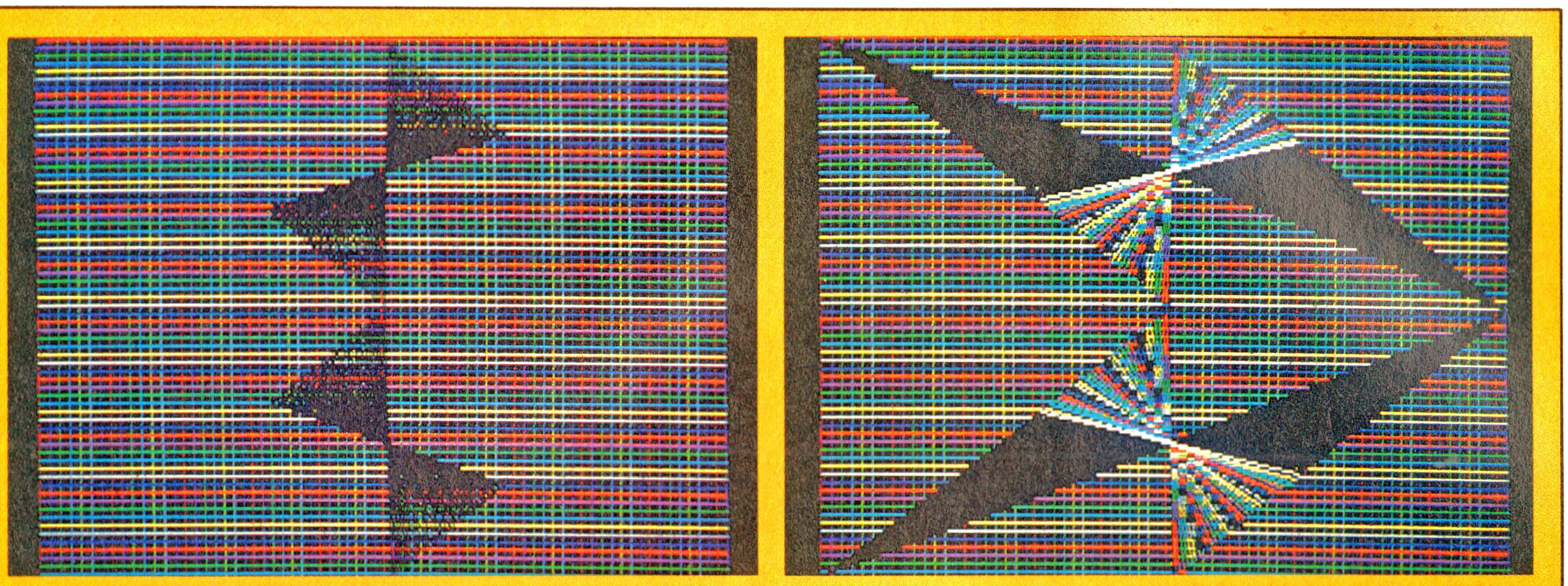
He began working with computer graphics at the New York Institute of Technology in the mid-1970s, completing the classic *Sunstone* with Alvi Ray Smith. "That was an exciting project," recalls Emshwiller. "I spent many nights playing with three-dimensional images, asking Alvi if I could rotate this shape or expand that one. The medium allowed a lot of spontaneity. Changing forms, shapes, and color was very easy compared to media like painting or video. What came out was a flower that blossomed and grew before my eyes."

Students at Cal Arts won't be using the same sophisticated computer equipment Emshwiller worked with at NYIT. The price of a single VAX system (a larger computer system) will buy dozens of personal

computers, and, with the increasing sophistication of personal computer graphics, Ataris and Apples will provide more than enough experience for the beginning computer-graphic artist.

Emshwiller feels it's important that we see the computer as more than a machine. "People get absorbed in technical, mechanistic approaches to tools like computers. Any kind of real significance gets lost that way. Computer graphics allow us to create a visible manifestation of imagination. Art is a means for people to understand each other, like life itself."

For further information, contact Ed Emshwiller, California Institute of the Arts, 24700 McBean Parkway, Valencia, CA 91355.

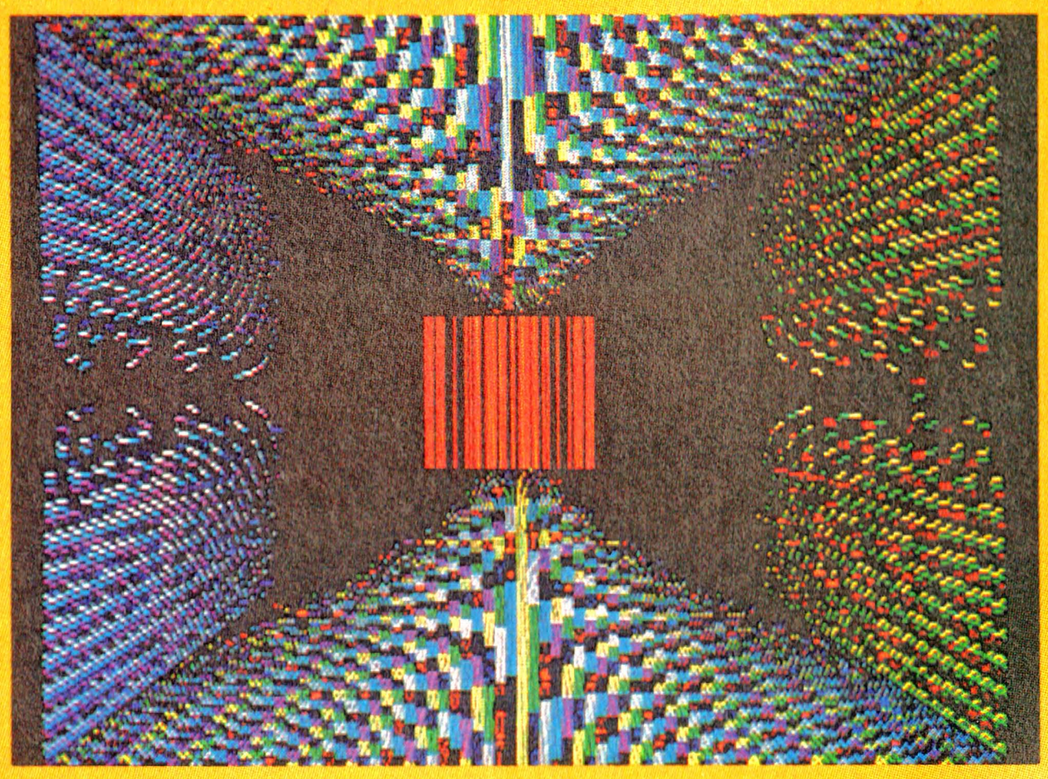


Color Graphics: State of the Art

The color displays reproduced here were created by the Japanese Hitachi MB-6890 personal computer reviewed last month in *Popular Computing*. A new computer with many of these same stunning graphics capabilities is presently being developed by Hitachi for the U.S.

Notice the extremely high resolution (fine detail) and the brilliance of the colors. Among American personal computers, only the IBM unit offers this high level of visual quality.

The display monitor is as important as the computer in producing graphics of this quality. For highly saturated colors and highest resolution, so-called *direct-drive* monitors are needed rather than home television sets or composite-signal video monitors. The Hitachi and IBM computers both offer outputs for direct-drive display monitors.



Patterns shown are generated by a complex interaction of BASIC-language mathematical routines and color graphics commands with names like LINE (draw a line) and PSET (set or light up a point).

These displays possess an element not evident from photographs: motion. When viewed on the screen, the patterns appear to rotate, creating a kaleidoscopic effect. The rotation is accomplished not through BASIC statements but through calls to external machine-language routines.

In addition to creating abstract, multicolored patterns, the Hitachi can generate finely drawn, realistic pictures, although usually at the expense of the variety of colors that can be used at one time.

Expect other personal-computer manufacturers to introduce top-notch color graphics systems in the coming year—and with them, new kinds of software products to bring out the artist in you!

Animation Grows Up on Personal Computers

Computer graphics and animation techniques have in the past been available to a select few. Such individuals studied these topics in academic and professional environments with the aid of advanced mainframe and minicomputer systems.

Apple and Atari computers have done much to change this, however. Over the last couple of years, new graphics techniques have been developed with these machines in mind. In some respects, the results rival those obtained in professional computer-animation settings.

"It is really quite mind-boggling," says Mitch Waite, author of several technical books on personal computers. "About seven dollars' worth of microcomputer chips gave the Apple II color-graphics capability with a resolution of 280 by 192 points. Over 35,000 Apple owners are becoming familiar with and evolving new graphics routines. This far outnumbers the members of professional animation and graphics organizations. A lot of creative approaches and applications of graphics and animation are evolving that wouldn't have existed if it weren't for low-cost computing."

Note that creating complex graphic animations on inexpensive computers has some limitations. For example, resolution is quite a bit lower than with more expensive computers. This drawback is related to memory requirements for graphics. A graphics display with 1000 by 1000 pixels (picture elements) requires at least one million bits of memory. If each pixel is to have multicolor capability, at least eight bits of memory per pixel are required. This translates into eight million bits of RAM (random-access read/-write memory) for a reasonably high-resolution graphics display. If memory costs continue to drop, a low-cost computer could have that capability within three to five years.

Another limitation of inexpensive graphics systems is the color capability of standard 525-line television sets. Should Sony's new high-resolution, 1150-line TV set become standard, we can look forward to higher resolution and more color capability on our home computer systems.

Other restrictions are related to the hardware of the computer itself. The Apple, for example, can't shade the edges of objects to reduce the sharp, sawtooth-like appearance of curved or diagonal lines. The Atari 800, on the other hand, because of its luminance-control capability, doesn't have this problem.

"In many ways, the graphics limitations of these personal computers are an asset," comments Waite. "For example, the screen map of the Apple (i.e., the way the picture is stored in pieces in the memory) is quite Kafkaesque. I found it a real challenge to design an algorithm for accurate screen mapping. It was an incentive to be really creative. These constraints are actually holes, and by passing through them, a whole new way of looking at things emerges."

Waite, along with David Fox, is writing a book on personal-computer animation techniques. "We are focusing on the Atari 800 because of its amazing graphics capability," says Fox. "Atari spent over $10 million to develop three special graphics chips. About 90 percent of the Apple's capability is now known, but only about 60 percent of the Atari system has been explored." Waite and Fox's book, which will cover animation concepts, theory, and programming, is directed toward new microcomputer users, with special emphasis on animation in the classroom.

The authors are interested in communicating with other personal-computer users involved with animation techniques and may be contacted at the Marin Computer Center, 50 El Camino Drive, Corte Madera, CA 94925.

TRON—New Disney Sci-Fi Extravaganza

A computer graphics extravaganza will be coming from Disney Studios this summer. *TRON* tells the futuristic story of a young computer genius who short-circuits his computer and is drawn into a universe of electricity and light. Sound good so far?

Well, it gets better. The film examines how the information we feed our machines creates an alter-ego in a computerized, digital world. One of the main questions raised is whether or not humans can create an intelligence greater than their own.

Story line aside, the special effects should be nothing less than incredible. Disney Productions has lined up some of the best computer-graphics groups in the country to create the visuals. Robert Abel and Associates of Hollywood has been signed to create a main title sequence. Using an Evans and Sutherland computer, the sequence will depict video warriors and computer programs fighting for survival in an electrical world. Abel is in demand for his high-tech filmmaking, as evidenced by Levi Strauss, 7-Up, and Bell System television commercials.

High-power computer graphic companies such as Information International, MAGI, and Digital Effects will also be producing special effects for *TRON*. Wendy Carlos, a true virtuoso on the synthesizer, will compose the film's score. She's best known for her work on *A Clockwork Orange*, *The Shining*, and the album *Switched-on Bach*.

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If you own an Apple™ or are thinking of owning one, here is what you should know about Super-Text™!

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— Many many more features and options that save you time and eliminate drudgery.

Super-Text™ also has a built-in Math Mode which allows you to use your Apple™ as a 15-digit calculator even though you're still in the word-processing program.

Super-Text™ comes with extensive instructions and tutorial documentation, a Reference Card, dual disk protection and an unlimited time damaged disk replacement policy.

Super-Text™ for the Apple™ II or II Plus with 48 K and disk drive (dual DOS 3.2/3.3). $150.

MUSE Software
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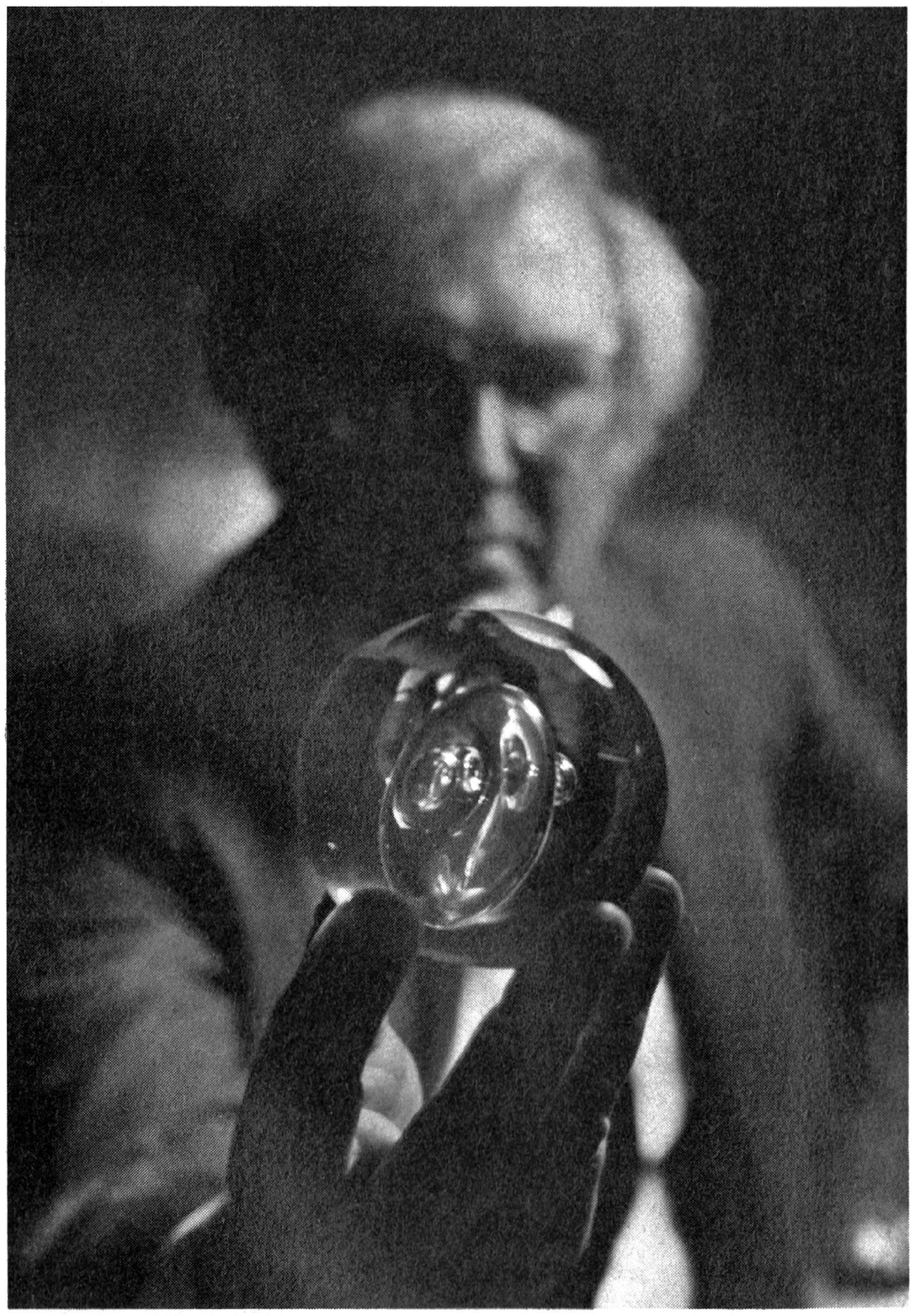
Balto., Md. 21201
(301) 659-7212

Apple II is a trademark of Apple Computer Corp.

Update



What If They Forget Where They Hid It?

Computer adventure games have intrigued enthusiasts for years, but once the adventure was over, the only recourse for eager travelers was to purchase a new game. Level 10, a division of Dakin5 Corporation, has added a novel twist to video adventure.

Alkemstone, the Colorado firm's new game, offers words, sketches, and clues randomly scattered throughout the adventure that, when pieced together, point to the hidden location of the actual Alkemstone. To claim a $5000 prize for being the first to find the Alkemstone, treasure hunters can go after the stone or decribe its exact location to Raymond Sutton, Jr., of the law firm Silver, Silver, Sutton, and Kelly in Denver, Colorado, which is the independent judging organization.

"All I can say is the Alkemstone is hidden somewhere on the planet," says Marlene Kukla, Level 10 spokeswoman. "The only one who knows its location is Eugene Carr, president of the company."

Alkemstone features color graphics, 3-D animation, sound effects, and an illustrated short story. It requires an Apple computer with 48 K bytes of memory and one 16-sector disk drive. The game is available from most Apple dealers.

What will happen when someone finds the Alkemstone? "Oh, we just might lose it again," says Kukla.

Circle 46 on inquiry card.

New Products

Colorful Word Processing

Now you can process your words in color with the NEC PC-8000 word-processing computer system. The system includes a self-teaching program, 12,000-word dictionary, color monitor, printer, I/O (input/output) unit, and disk drive for under $6000.

Text appears in green, with instructions in yellow or blue and potential deletions highlighted in violet. The system is menu driven, with automatic page numbering, block moves, justification, an automatic disk-overflow routine, and single-key commands.

Contact NEC Home Electronics USA, Personal Computer Division, 1401 Estes Ave., Elk Grove Village, IL 60007, (312) 228-5900.

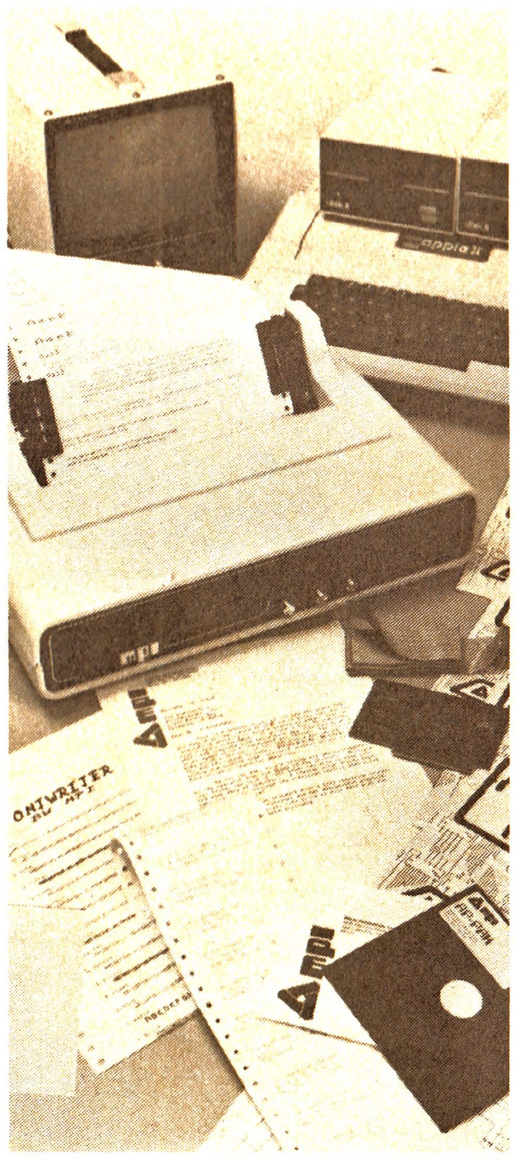
Circle 217 on inquiry card.

Old English from Your Apple

You can generate a document in Old English, Yiddish, or Gothic character style with the Applications Package from MPI. It also allows Apple II users to create graphics for letters and reports.

Designed for use with the MPI line of graphics printers, the package consists of a printer interface, the Font Writer program, and a Letter Post program for generating form letters. Both programs are compatible with the Apple text editor. $145 from Micro Peripherals Inc., 4426 South Century Dr., Salt Lake City, UT 84107, (801) 263-3081.

Circle 218 on inquiry card.



TRS-80 Interface for Hams

Using a Morse telegraph key isn't exactly twenty-first-century technology, but amateur radio operators know that Morse-code transmissions can get the message across when voice communications are impossible. Now ham operators can have the benefits of code communications without learning Morse code.

MFJ Enterprises offers a combined hardware and software package that turns the Radio Shack TRS-80 Model I or III computer into a Morse-code send/receive terminal. Messages typed on the computer keyboard are translated into code and transmitted through the MFJ interface. Incoming code is translated into text and is displayed on the computer screen.

Messages of almost 3300 characters can be prestored in the computer's memory, allowing fast transmission, even for hunt-and-peck typists. The software features ten programmable memories for frequently used messages.

The interface connects the TRS-80 to your transceiver with no modifications. The program, supplied on cassette tape, may also be used with disk systems.

The package sells for $99.95 plus $4 shipping and handling: Contact MFJ Enterprises Inc., POB 494, Mississippi State, MS 39762, (800) 647-1800.

Circle 219 on inquiry card.

High Motivation

A new educational series called the High Motivation Reading Series has just been launched by Radio Shack for the TRS-80 32K Model I computer.

The series, for grades 4 to 6, includes four student readers, a read-along audio cassette, teacher's manual, and computer program to test various skill areas.

Titles in the series are *Charles Lindbergh/Amelia Earhart* ($64.95), and *The Hound of the Baskervilles*, *Moby Dick*, *Dracula*, *The Beatles/John Lennon*, and *20,000 Leagues Under the Sea* (each available for $59.95). Computer-based activities involving each story are designed to give students practice in vocabulary and reading comprehension.

The High Motivation Reading Series requires the TRS-80 Model I with lowercase option, one disk drive, and TRS-80 PILOT Plus ($79.95). Contact your local Radio Shack dealer.

Circle 221 on inquiry card.

Get SMART

The Securities Market Analysis, Reporting and Transaction system (SMART) can help Apple owners organize money-management and investment data with graphing, storage, retrieval, and economic-analysis functions. A portfolio module maintains and reports data and transactions for securities, and the graphing function has open-high-close charts, volume histograms, line charts, and point plots. Analytic tools include moving averages, exponential smoothing, momentum, trend lines, and user-defined formulas.

SMART requires an Apple II Plus with 48K bytes of memory, two disk drives, modem, display, and printer.

You can get SMART for a $1400 base price (which includes Analysis and Graphics); additional modules are $350 for Communications, $250 for Statistics, and $150 for Account Monitoring. A yearly license fee of $850 is required (included in the first year's purchase) and annual updates and a company newsletter are included. Contact Marv Goldschmitt, Software Resources Inc., Suite 310, 186 Alewife Brook Parkway, Cambridge, MA 02138, (617) 497-5900.

Circle 220 on inquiry card.

Free Corvus Catalog

Personal-computer disk systems, add-on drives, backup-systems products, network multiplexers, interface cards, cables, demonstration kits, software, accessories, and manuals are just some of the products described in a new catalog, free from Corvus Systems. Contact Corvus Systems Inc., 2029 O'Toole Ave., San Jose, CA 95131, (408) 946-7700.

Circle 223 on inquiry card.

The Apple Family

Apple Computer Inc. has taken existing Apple products and wrapped them into the Apple Family System, a package designed for first-time computer users. Personal finance and budgeting, record keeping, letter writing, skill-building games, and more, are covered in the packages, and a software directory for future purchase is included. Components of the Family System also include a 48 K Apple II Plus computer, disk drive with controller card, hand controllers, RF modulator, and assorted programs. Suggested retail price is $2495.

An owner's guide (everything from unpacking to using software), as well as a complete library of Apple II user manuals, comes with the system. Growth-path suggestions help families decide how to take advantage of increasing application potential.

Contact your local Apple dealer or write Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

Circle 222 on inquiry card.

TRS-80 Cash Registers

Turn your TRS-80 into a cash register with the CR-180, a cash register/POS (point-of-sale) expansion system developed by Integrated Cash Register (ICR) and Futuresoft.

The system has an electronic cash drawer and a receipt printer that plug into a TRS-80 Model III. It records eight types of payments, stores transactions for up to 100 employees, reports on daily sales, cash, and gross profits, and handles inventory control.

Continuous instructions to point-of-sale operators are provided and owners can program the CR-180 to add promotional messages to customer receipts.

Prices range from $900 to $1900. Contact ICR/Futuresoft, POB 1446, Orange Park, FL 32073, (904) 269-1918.

Circle 232 on inquiry card.

Legal Briefs

Big on law, bad on spelling? No problem. Innovative Software Applications (ISA) has developed a software dictionary for the legal profession.

Compatible with ISA's spelling-correction program, Spellguard, the SP-LAW dictionary includes over 15,000 legal terms, reference words, and Latin phrases. The dictionary also contains the 20,000 general-use words available with Spellguard, and can be expanded up to the full capacity of the disks.

SP-LAW requires a CP/M-based computer with 32K bytes of memory, one disk drive, Spellguard, and a word-processing program.

SP-LAW sells for $125; Spellguard lists at $295. Both are available from ISA, Suite 300, 260 Sheridan Ave., Palo Alto, CA 94306, (415) 326-0805.

Circle 231 on inquiry card.

Put It in Your Pocket

The first book of software written especially for the Radio Shack Pocket Computer is entitled *Murder in the Mansion and Other Computer Adventures in Pocket-BASIC for the TRS-80.* Released by ARCsoft Publishers, the 64-page book includes BASIC programs for adventure, space, number, memory, and other games. Cost is $5.95 plus $1 shipping.

With simple modifications to the program listings, the games in the book can be run on any BASIC system.

Contact ARCsoft Publishers, POB 132XY, Woodsboro, MD 21798.

Circle 230 on inquiry card.

Desktop Computer from TI

Texas Instruments has announced System 200, specifically designed as a "first computer" for small businesses.

Based on TI's 16-bit microprocessor, the System 200 comes with 64K bytes of memory and uses the new 64K-byte memory chips for improved reliability and cost effectiveness. The System 200 has four models, differing only in disk storage capacity, from 1.2 to 11.2 megabytes. The lowest-priced model uses 5¼-inch floppy disks: others use hard disks.

A diverse lineup of programs is available for the system. TI states that its business software will be audited and approved by one of the big-eight national accounting firms for adherence to accepted accounting practices.

Base price for the system is $6200. Contact Texas Instruments Inc., POB 2909, Austin, TX 78769, or your local TI dealer.

Circle 229 on inquiry card.

Action Computers

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Centronics Printer Sale

Completely Refurbished, 30 Day Warranty

Model #		
101	165 c.p.s., 132 print positions, 5 x 7 dot matrix, areal work horse	only $449.00
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102A	330 c.p.s., 125 L.P.M. bi-directional print 9 x 7 dot matrix	only $949.00
*306	The best of Centronics line at the best price, compact, 120 characters per second, 5 x 7, VFU, top of form and more	only $689.00
	Quietizer covers available for this model only	only $ 89.00
501	165 c.p.s., 30 L.P.M. at 132 character lines, 150 L.P.M. at 30 character lines, 5 x 7 dot matrix, sprocket feed, motor control	only $600.00
503	165 c.p.s., sister to the 501 with bi-directional print at twice the speed — self tests	only $700.00

- Print stands available for all models only $ 70.00
- Paper catchers for all models only $18.00
- Inforex 9" CRT w/power supply and keyboard as is: only $35.00

Options

- Add lower case to most Centronics Printers only $89.00
- Foreign character sets available.
- Add Motor Control to your 779 printer only $95.00

Our Conversion Kit I gives most Centronics printers the ability to print in upper and lower case - $89.00
Our Conversion Kit II turns your motor on and off automatically. Increases the life of your printer $95.00
Both kits require **NO** soldering, etch cuts, software mod. or interface. Easy Installation.

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- Now use your Centronics Parallel Printer on any Computer with a serial Port. Available in four models all with switchable baud rates.

Model	
CSP - 100	
No buffer	only $175.00
CSP - 200	
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CSP - 200X	
X on/X off Protocol	only $340.00
CSP - 2000	
2048 char. buffer	only $395.00
PS Models	
parallel to parallel devices	$125.-$150.
PPS Models	
Software control serial to parallel or combination, multiple ports	$350-$395
MS Model	
Single modem shared by 4 devices	$310

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Circle 61 on inquiry card.

Episode Computer Work Station

Epic Computer Corporation announces a computer workstation for office use. The Episode does not include the usual peripherals, such as video display and keyboard; instead, it has standard interfaces for such devices, allowing for greater flexibility.

The unit, approximately the size of a breadbox, has a Z80A microprocessor and two floppy-disk drives capable of single- or double-density storage. Also included are an RS-232C communications interface, a parallel-printer interface, and a real-time clock and calendar.

The computer comes with the CP/M operating system and the new Supervyz program designed to make the system user-friendly. Among the applications software for the Episode are the Wordstar word-processing program, Datastar, Spellstar, Mailmerge, and Supercalc (an electronic spreadsheet).

Prices for the Episode begin at $2550. Contact Epic Computer Corporation, 7542 Trade St., San Diego, CA 92121, (714) 569-0440.

Circle 228 on inquiry card.

Mostly BASIC

Three new Mostly BASIC packages for TRS-80 and Apple users are available from Advanced Operating Systems.

The Mostly BASIC Educational Program Package is a series of seven programs for kids that turns your microcomputer into a learning center with fundamental games and tests for memory, spelling, reading, and math skills.

The Mostly BASIC Household Program Package includes 10 programs covering diet, electric-energy use, gas mileage, and medical records. The household package also has a Tarot-card reader and house-buying guide.

The Mostly BASIC Scientific Program package lets you experiment with a telephone dialer, hexadecimal/decimal and decimal/hexadecimal conversion, a computerized clock, and other assorted problems.

The Mostly BASIC programs are on cassette for TRS-80 users and on disk for Apples. Prices vary. Contact Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360, (219) 879-4693.

Circle 227 on inquiry card.

Toshiba Word Processor

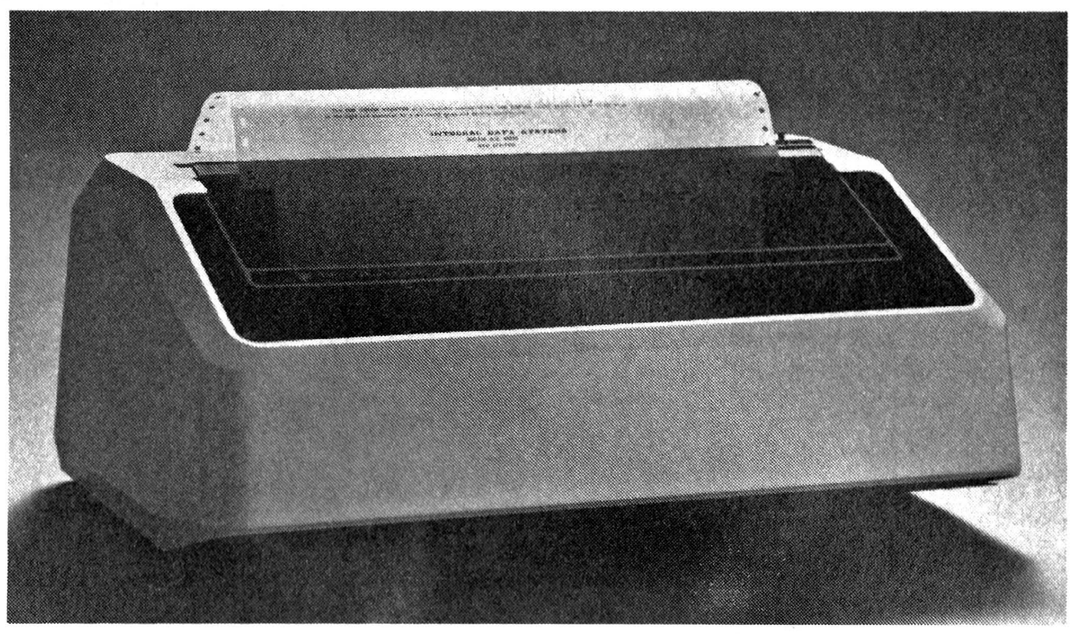
Tired of "adding on" to your word processor? Toshiba America Inc. promises you won't have to with the new Toshiba EW-100, a user-friendly, software-based word-processing system.

The EW-100 can store up to 460 pages of text on a single double-sided, double-density floppy disk, and up to 920 pages with two disks. The system also features a 45-character-per-second daisy-wheel printer with selection of fonts, global search and replace, glossary, word wrap, and automatic centering, decimal tabulation, and underscoring.

The EW-100's 12-inch screen displays 24 lines of 80 characters and includes a horizontal and vertical scrolling feature. The 75-key electronic keyboard is separate from the video display device, and the entire system is designed for desktop use.

The EW-100 is priced at $7250. Contact the Marketing Department, Toshiba Information Processing Systems Division, 2441 Michelle Dr., Tustin, CA 92680, (714) 730-5000.

Circle 226 on inquiry card.



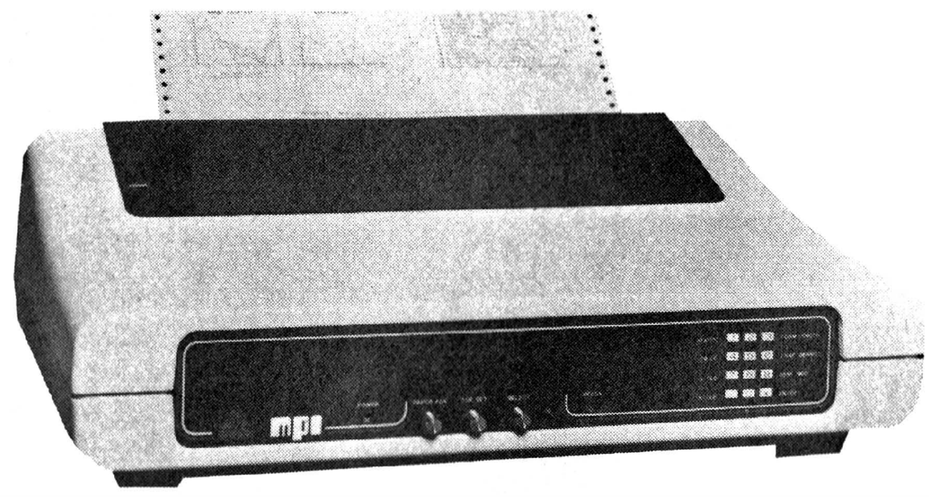
Put Your Colorful Ideas onto Paper

The Prism Printer from Integral Data Systems offers full-color graphics and text printing for under $2000. Unlike color plotters currently available for personal computers, the Prism Printer uses a four-band color ribbon and a dot-matrix mechanism to create full-color graphics, charts, figures, and text.

In its data mode, the unit prints up to 200 characters per second. A text mode is also available for letter-quality output. The unit can handle 15-inch-wide data-processing forms and 8½-inch-wide sheets.

Word-processing features include proportional and monospacing, bold printing, automatic text justification, reverse paper feed, and microspacing between characters. Special type fonts will also be available. Contact Integral Data Systems, Milford, NH 03055, (603) 673-9100.

Circle 225 on inquiry card.



Business Printer

Want to write a letter after you finish your accounting report? The MP150 dot-matrix printer handles the 15-inch-wide forms required for accounting and business reports, as well as 8½-inch letter and other sizes. The unit prints up to 150 characters per second and offers two character styles—one for data processing, one for word processing.

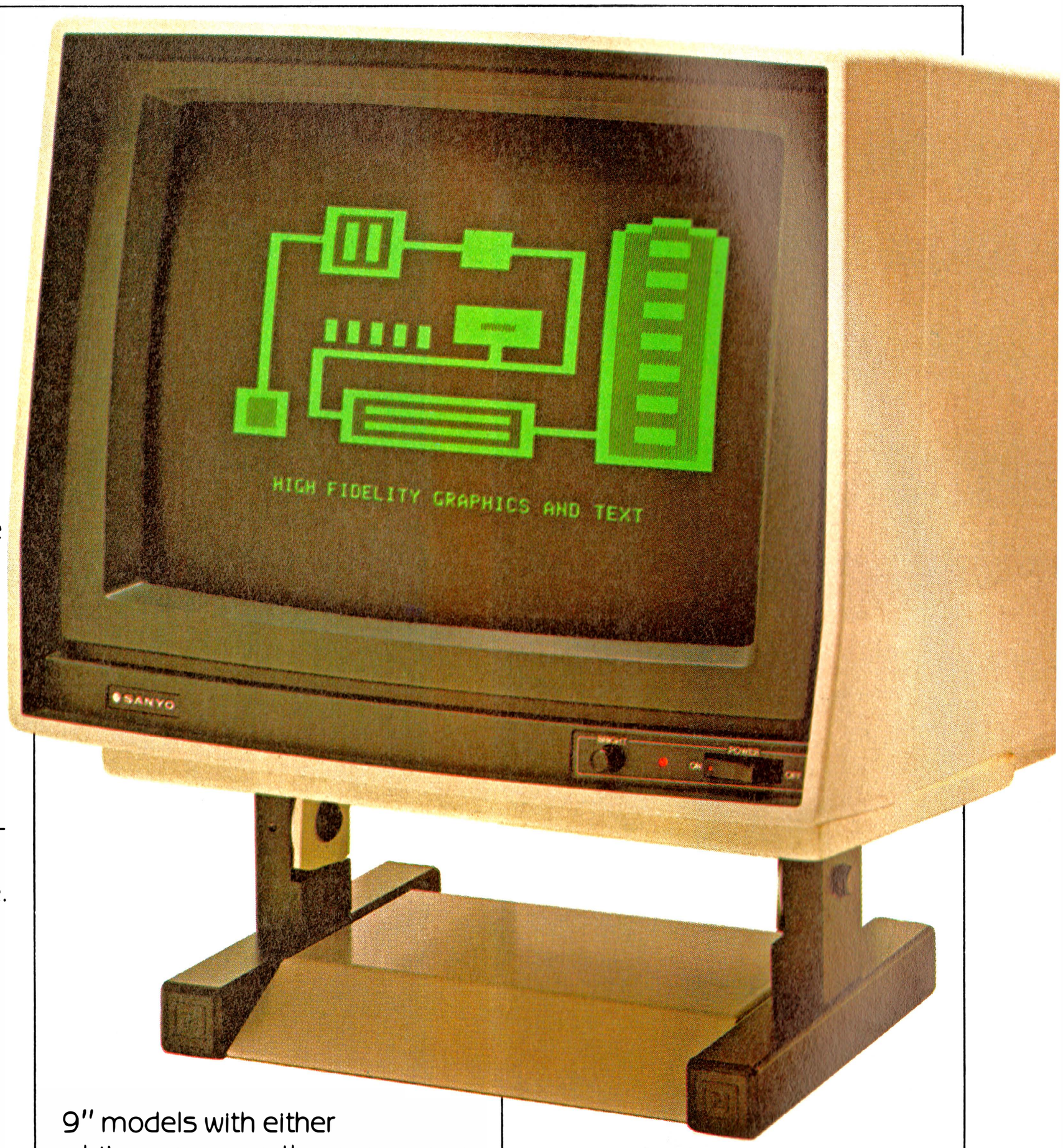
In addition, the printer can create dot-graphics, which allows you to plot, copy computer displays, and produce special characters.

The MP150 is available with a parallel or serial interface. Base price is $1095. Contact Micro Peripherals Inc., 4426 South Century Dr., Salt Lake City, UT 84107, (801) 263-3081.

Circle 224 on inquiry card.

SANYO MONITORS

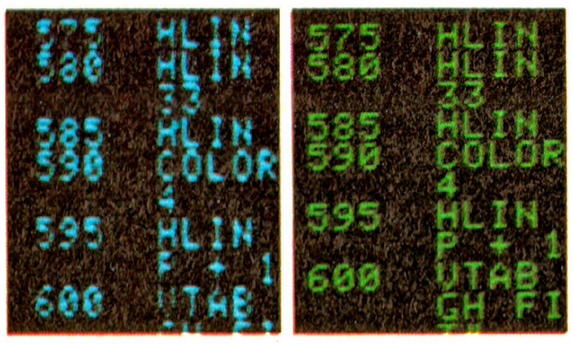
When you're ready to stop playing around.



Maybe your home TV was OK as a display when all you were concerned with was blasting Klingons.

But if you spend more than a couple of hours in front of your TV screen, you'll start to pay the price in eyestrain. Maybe even headaches.

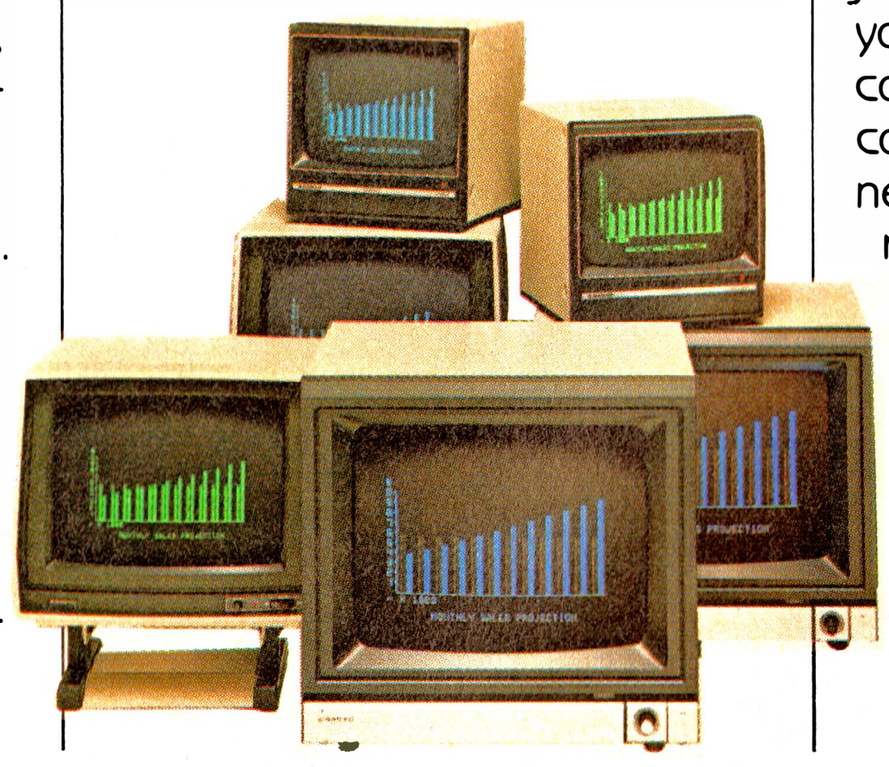
It's not worth it. Not when you can get a Sanyo data monitor that's specifically designed for long-term, day-in, day-out use.



Compare display quality of a typical home TV (left) with a Sanyo professional monitor (right).

Sanyo monitors have been the industry standard for as long as there's *been* a personal computer industry—in fact they're recommended by computer dealers and manufacturers alike. That's because when you buy a Sanyo, you're not just getting a stripped-down TV set. You're getting a truly professional display system.

Sanyo offers a complete selection of monitors for any application. You can choose from 9" models with either white or easy-on-the-eyes green phosphors. Or a sleek new 12" model with a special anti-reflective screen (green or white), and an optional desk stand with adjustable tilt. If color graphics are your thing, check our 13" full-color models—one with TV-compatible video input, and a new ultra-high resolution RGB model for computers like the IBM, NEC and Apple III.



Visit your computer dealer and find out how much better things look on a real, professional monitor from Sanyo.

Anything less is just playing around.

SANYO

Communications Products Division
Sanyo Electric Inc., 1200 W. Artesia Blvd., Compton, CA 90220 (213) 537-5830

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Circle 60 on inquiry card.

The IBM Personal Computer, with curved-plane keyboard, monochrome display, system unit with disk drives, printer, and printer stand.
Inset: Color graphics are easy to use with Advanced BASIC.

THE IBM PERSONAL COMPUTER

It sets new standards for small computers.

by George Stewart

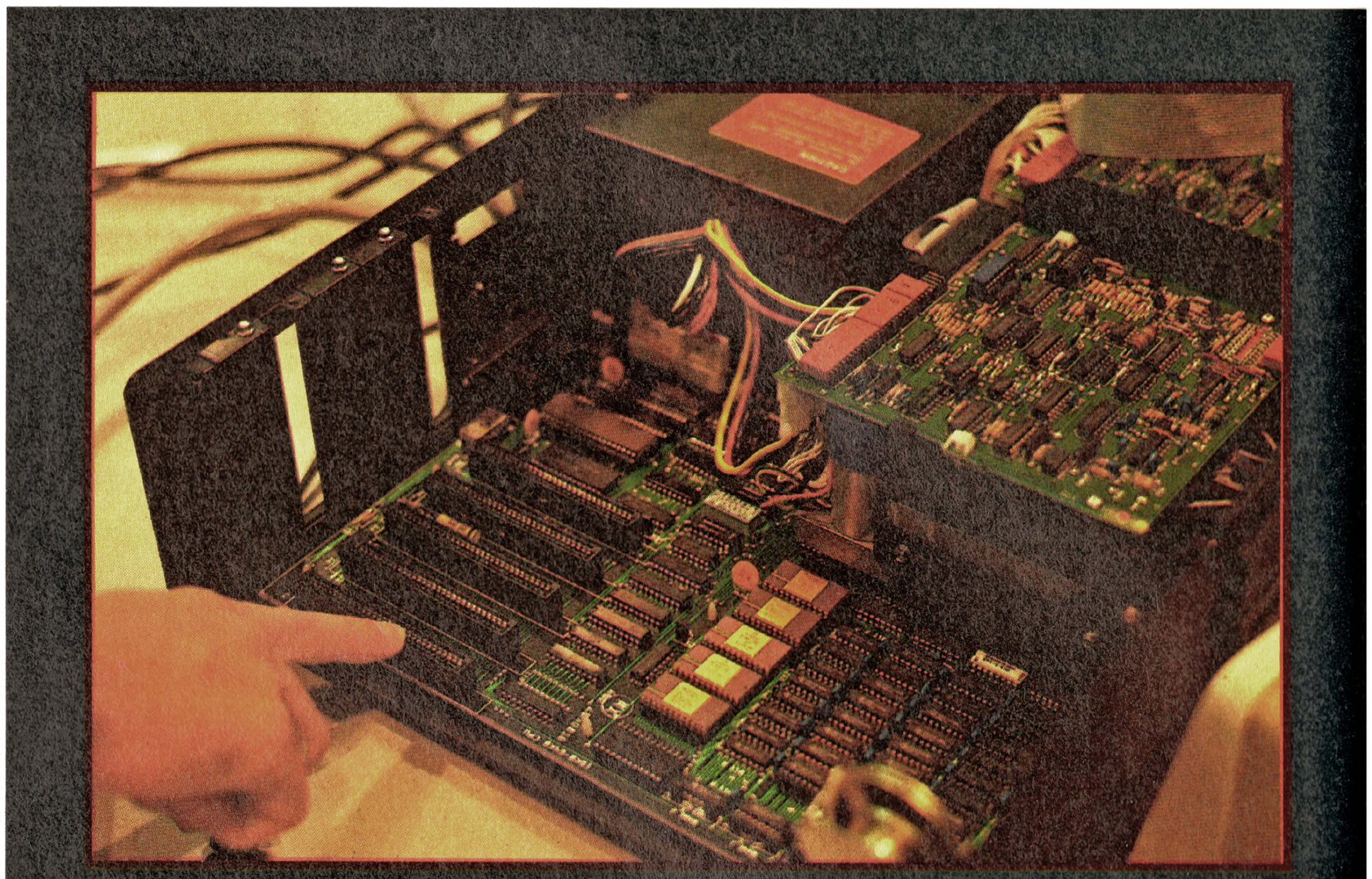
The dust has finally settled since IBM stormed the personal-computer world last August. In an amazingly short time, the IBM Personal Computer has set a new yardstick of excellence in an industry known for innovation. Hardware and software manufacturers now talk increasingly of IBM's Personal Computer as *the* competition and *the* standard.

Confirming this belief, the president of Apple Computer Inc., A. C. Markkula, told the *Wall Street Journal*, "I think this market will see a top three emerge: Apple, IBM, and, with reasonable probability, one Japanese company." With one broad stroke Markkula surprisingly dismissed such previously formidable competitors as Tandy, Atari, and Commodore in deference to Big Blue (as IBM has been known for years throughout the industry).

Microsoft President Bill Gates, whose company has provided BASIC language interpreters for almost every personal computer, is similarly impressed. "As a result of IBM's super-extensive testing [of Microsoft's languages for the Personal Computer], the quality of our [16-bit computer languages] is higher than even our most mature 8-bit [computer languages]."

Early acceptance by consumers has been equally impressive. Calls to five Computerland stores and the Sears Roebuck computer store in Chicago reveal that only the Chicago Sears store is presently able to stock the units for off-the-shelf sales. Computerland stores surveyed report that their shipments are all presold, with a waiting period of 10 days to two months. Store managers report that interest in the new IBM Personal Computer is divided between businessmen and professionals, with home users a distant third.

Why are people waiting in line to pay $3000 and up for the disk- and printer-equipped systems? Should you buy one? To help answer those questions, here's a report on the IBM Personal Computer.



Five expansion slots are available for adding memory and adapters for display and printer, color graphics, disk drives, serial communications devices, and other peripherals.

Using the monochrome display, text characters are especially well defined, and simple graphic pictures are possible.

A Revolutionary Computer?

At first glance, the IBM Personal Computer system may look like a revolutionary product. However, taken feature by feature, the IBM offers little that can't be found in other personal computers. The real distinction of IBM's computer is in the *way* these features are incorporated into one product. It is the *definitive* personal computer.

The Personal Computer's 16-bit

microprocessor is a generation ahead of the 8-bit brains in almost every other small computer. It allows the Personal Computer to give you much more internal memory than other small computers while still reserving vast amounts of memory for its own sophisticated uses. The microprocessor also gives the Personal Computer a potential advantage in processing speed.

The hardware—case, keyboard, display screen, connection facilities, internal design—sets new standards in excellence. Unlike many other small-computer manufacturers, IBM doesn't have to go through a learning curve in terms of design and manufacturing techniques; it did that long ago. As a result, examples of first-time-around excellence abound. The connectors and cables are heavy-duty. The display doesn't jitter whenever you turn on the disk or printer. It's not crucial that you remove a disk before turning power on or off. Each user-memory cell in the computer has a watchdog to tell you immediately when something's wrong. (Other computers let you know by going "flaky.")

IBM's years of experience serving keypunch operators, data-terminal operators, and typists shows in the excellent human engineering of the keyboard, screen, and system software. The Personal Computer's gently curved keyboard makes ordinary keyboards seem old-fashioned. IBM's monochrome display is the nonglare, green-phosphor type—easier on the eyes than the standard black-and-white models (and *far* easier than television screens). The programmable function keys make it easy to treat the computer as a tool, without becoming bogged down in repetitious typing of commands.

The manuals provided with the system, while not the most creative or graphically stunning, are competent and complete. Seven manuals document the basic system of hardware and software. Once again, the experience of a company that has sold office products for many decades is evident.

The Basic System

A minimal system that lists for $1945 includes the system unit, keyboard, and monochrome display ($1565 buys the same system with color capability instead, but the color monitor or television interface is not included).

System Unit. Technically, the system unit is the heart of the Personal Computer. This breadbox-sized case houses the 8088 microprocessor, read-only memory (ROM), random-access memory (RAM), power supply, and five expansion slots. On the rear of the unit are connections for all the peripheral devices, including a power outlet for the monochrome display.

> IBM doesn't have to go through a learning curve in design and manufacturing; it did that long ago.

The Intel 8088 operates on 16-bit units of data, rather than the 8-bit units used in every personal computer except Texas Instruments' model. Operations that can use 16 bits of data, such as multiplication and division, are correspondingly faster than they are on an 8-bit machine. However, all this takes place internally, in machine language. Depending on the application program or the language in use, you may not notice any speed advantage of the IBM over other personal computers.

A more significant feature of the IBM's microprocessor is its vast memory capacity. Other microprocessors can handle over 65,000 different storage locations; the 8088 can handle over one million. That's because its addressing system uses *20 bits* instead of the 16 available on other microprocessors. That's why the phrase "16-bit microprocessor" doesn't tell the full story.

The important question is how does all that power filter down to you. Simply put, the Personal Computer can be very generous in handing out resources for user memory, ROM, and video memory. Other personal computers have to accommodate all these memory-consumers inside a 64K-byte address space (1K bytes = 1024 bytes). In its present configuration, the Personal Computer allows up to 256K bytes of dedicated user memory.

The basic system comes with 16K bytes of user memory. You can expand that to 64K bytes without adding additional interface cards to the system. After that, each additional 64K bytes of memory uses up an expansion slot. For most applications you won't need more than 128K bytes of memory. Stuffing the system with 256K bytes would use up all but two of the expansion slots.

The system unit also includes a 1500-bps (bits per second) cassette interface for low-cost program and data storage. Any good-quality recorder/player may be connected to this interface. A speaker is also built-in. The Personal Computer uses it for error indications; through software, the speaker is capable of producing musical tones and sound effects.

Keyboard. If you're new to computers, IBM's keyboard may look complicated. In fact, it's a very versatile design. The keyboard has 83 keys. In the center are the ordinary typewriter keys. To the right is a numeric keypad for data entry and other special purposes. To the left are ten function keys, which allow instant entry of common commands and easy menu selection. In certain applications, these ten keys might be all an operator would ever have to type on. (IBM could have offered five function keys instead, and required you to press Shift to get the second set of five functions. That would have reduced cost, but would also have partially defeated the purpose: simplicity.)

If the ten special function keys aren't enough, an "alternate" key allows every text key to have a second meaning. For example, while typing in a BASIC program, pressing Alt-P generates the key-

word PRINT. Furthermore, numerous special-purpose keys are available for applications programs. "Page up" and "page down" keys, for example, are useful in word-processing and database-management programs.

Ninety-six text characters are commonly used in data processing. It's helpful to be able to generate each of these from the keyboard, but few personal computers let you enter all of them easily. The IBM does. In fact, you can generate 256 distinct character codes (the extra codes make the computer more versatile).

Press a key on the Personal Computer. You hear and feel when key contact is complete. That's important for touch-typists and data-entry operators. Type as fast as you like. The IBM keeps up easily because the keyboard has its own microprocessor. You can even type ahead, before the computer asks for input. If you type too many advance characters, a beep tells you to slow down.

Another nice feature is the six-foot coiled cord connecting the keyboard to the system unit. It gives you more flexibility in setting up a comfortable arrangement. The keyboard angle can be adjusted by using swiveled plastic legs at the bottom rear of the unit.

Monochrome Display. For this, you'll need the monochrome-display adapter, which also includes a parallel-printer adapter. (Most currently available printers for small computers require this type of adapter.) When using IBM's monochrome display, characters are well defined, even down to the serifs on numbers and letters. In all, 256 distinct characters are available, including uppercase, lowercase, punctuation, foreign-language elements, block graphics, and other graphic symbols. Characters may be displayed in many ways: normal, high intensity, reverse image, blinking, underlined, and invisible (useful for typing in passwords). The monochrome-display adapter allows 25 80-character lines.

The display's nonglare surface cuts down considerably on interference from overhead and background lights. Like the keyboard, the display is separate from the system unit, allowing

At a Glance

Name: The IBM Personal Computer

Manufacturer
International Business Machines Corporation
Information Systems Division
Entry Systems Business
POB 1328
Boca Raton, FL 33432

Components
System Unit
Size: width 20 inches, depth 16 inches, height 5.5 inches; weight (without disk drives) 21 pounds, (with two disk drives) 28 pounds
Electrical needs: 120 VAC
Microprocessor: Intel 8088
Memory: 40K bytes of built-in ROM (read-only memory), 16K bytes of user RAM (random-access read/write memory); expandable to 256K bytes
Standard: keyboard for data and text entry; audio-cassette recorder connector; five expansion slots for memory, display, printer, communications, and game adapters; built-in speaker for music programming; power-on automatic self-test of system components; BASIC-language interpreter; 16K bytes of user RAM (all user RAM includes parity bit)
Keyboard: total of 83 keys for data and text entry; includes 10 keys for numeric entry and cursor control, 10 special function keys, and ASCII characters and special graphics characters (total 256 characters); automatic repeat on all keys; adjustable typing angle; detachable six-foot coil cable
Disk drives: up to two 5-inch floppy-disk drives, 160K bytes each (will accommodate 4 drives in future)

Operating System
IBM Personal Computer DOS (Microsoft)

Software Available for IBM Personal Computer DOS
BASIC interpreter (Microsoft) standard; extended BASIC interpreter (Microsoft) $40; Pascal compiler (Microsoft) $300; Visicalc (Personal Software) $200; Easywriter (Information Unlimited Software) $175; General Ledger, Accounts Receivable, Accounts Payable (Peachtree Software) $595 each; asynchronous communications support $40; Adventure (Microsoft) $30

Hardware Prices

System Unit, 16K-byte RAM, keyboard	$1265
System Unit, 48K-byte RAM, keyboard, single floppy-disk drive, disk-drive adapter	2235
Monochrome video display	345
Combination monochrome-display adapter and printer adapter	335
Color-graphics-monitor adapter	300
16K-byte memory-expansion kit	90
32K-byte memory-expansion kit	325
64K-byte memory-expansion kit	540
Disk-drive adapter	220
Disk drive (5-inch floppy disks)	570
Asynchronous communcations adapter	150
Game-control adapter	55
Keyboard	270
Printer	755
Printer adapter	150
Printer cable	55
Printer stand	55

COMPUTER BOOKS FOR BEGINNERS

Everything you need to know to get started programming your own computer. These handy program sourcebooks, each jam-packed with easy-to-understand info for beginners, are crammed with hundreds of tips, tricks, secrets, hints, shortcuts, and techniques, plus hundreds of tested ready-to-run programs. TRS-80 Color Computer. TRS-80 Pocket Computer. Sharp PC-1211 Pocket Computer. Casio FX-702P Pocket Computer. Four of the most popular computers for beginners.

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55 Color Computer Programs for the Home, School & Office, practical ready-to-run software with colorful graphics, 128 pages **$9.95**

55 MORE Color Computer Programs for Home, School & Office, sourcebook of useful, plug-in-and-run software with colorful graphics, for TRS-80 Color Computer, 112 pages **$9.95**

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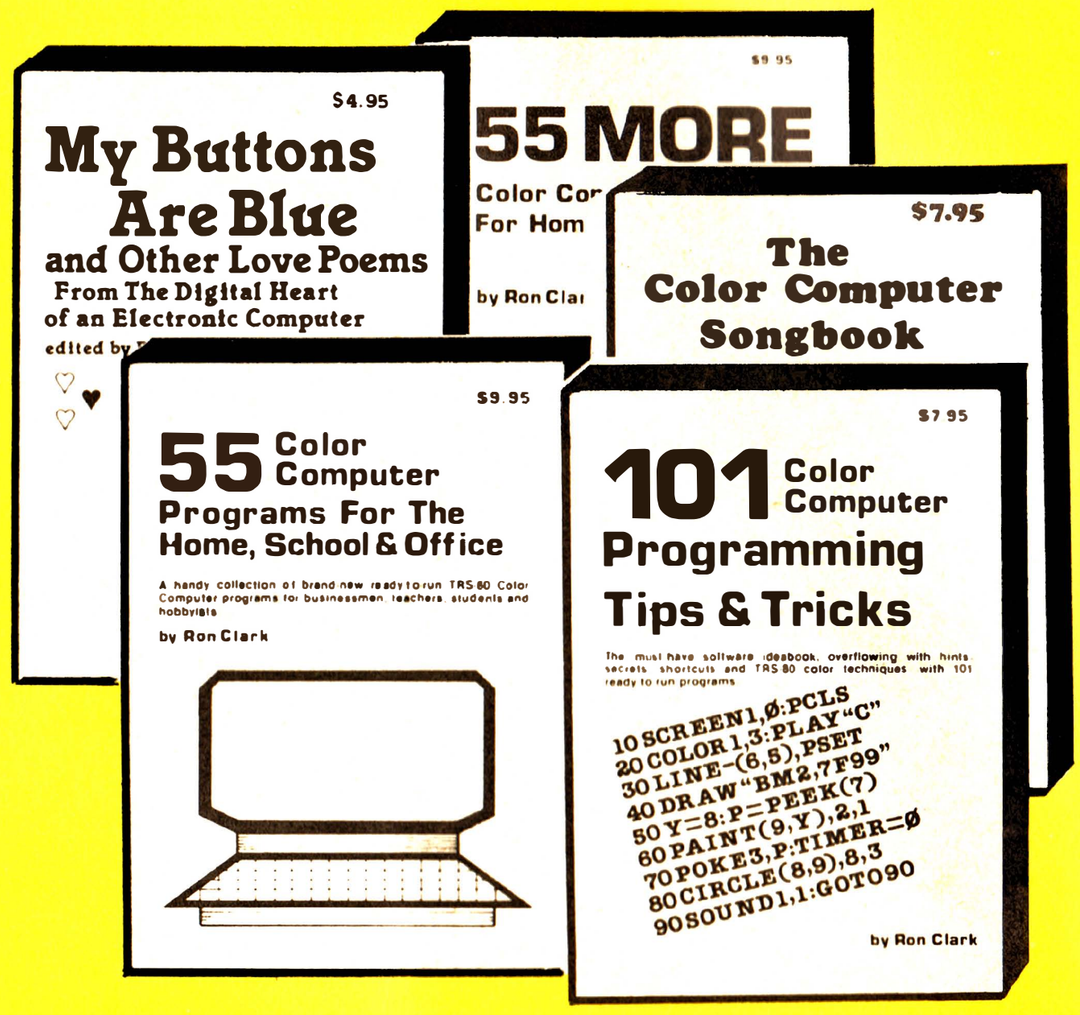
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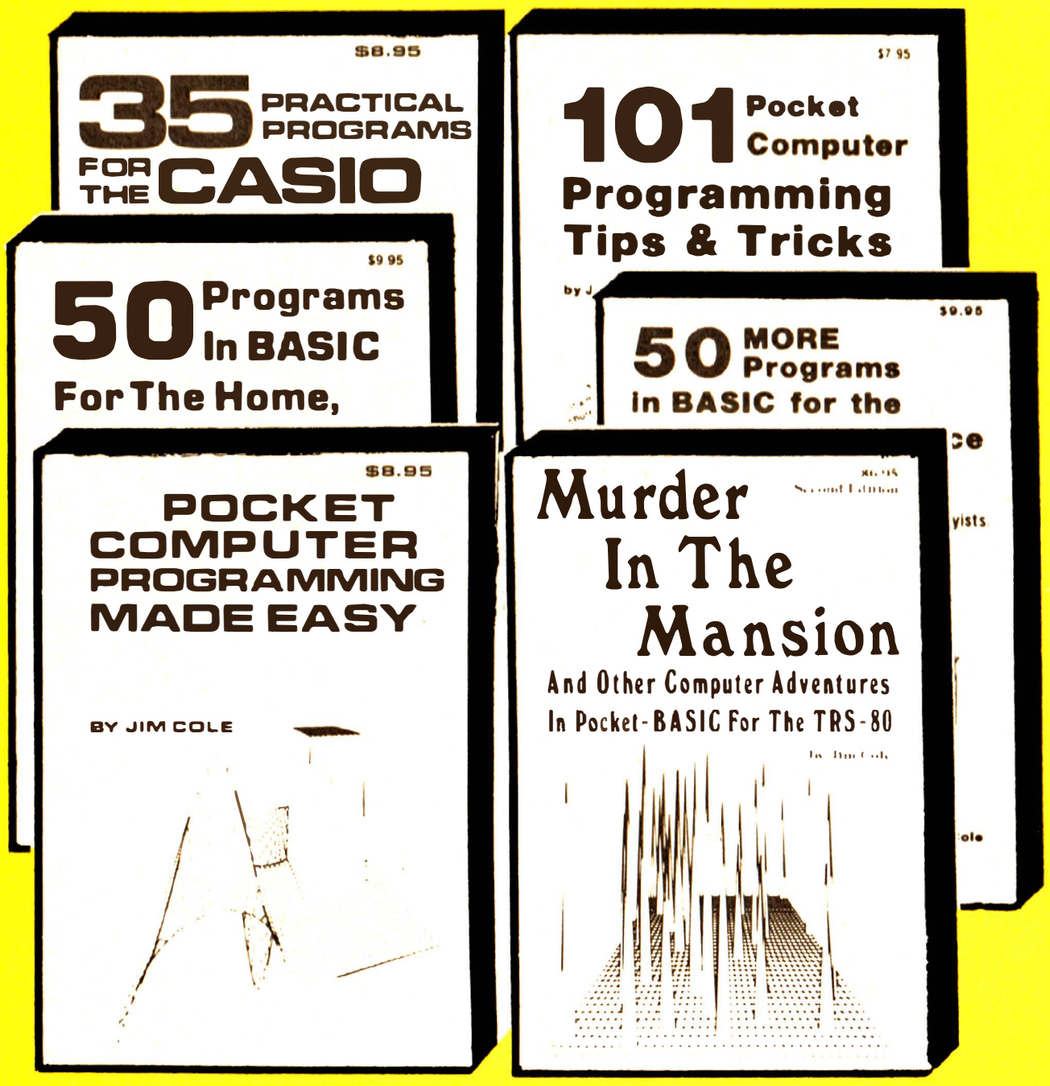
30 LINE-(6,5),PSET
40 DRAW"BM2,7F99"
50 Y=8:P=PEEK(7)
60 PAINT(9,Y),2,1
70 POKE3,P:TIMER=Ø
80 CIRCLE(8,9),8,3
90 SOUND1,1:GOTO90
by Ron Clark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Color Computer Coding Form	**$2.95**
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APPLE Computer Coding Form	**$2.95**
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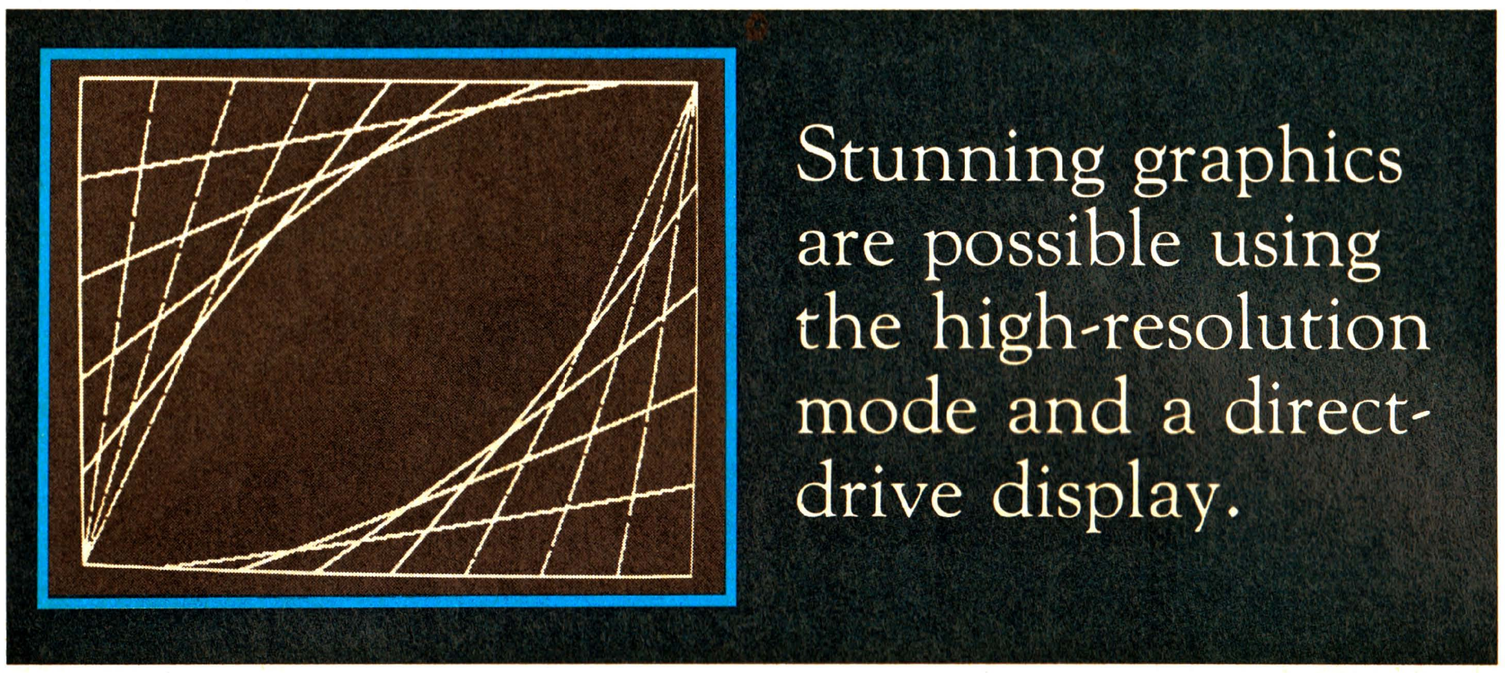
you to place it in a convenient position.

In short, the display keeps eyestrain to a minimum. Its only obvious limitation is the lack of dot graphics, the kind that allow free-form drawings. That requires the color-graphics adapter described later. However, the block- and character-graphics available are suitable for graphs and simple pictures.

same 256 characters are available as with the monochrome display.

The Personal Computer also features two dot-graphics modes, in which you can control any of the tiny points that make up the picture. Medium resolution offers 320 by 200 dot resolution with 3 foreground colors and any of 16 background colors. High resolution offers 640 by 200 dot resolution in black-and-white only. You can mix text (128 distinct characters) with graphics in the medium- or high-resolution modes.



Stunning graphics are possible using the high-resolution mode and a direct-drive display.

Options

You can choose from many options, and, as in choosing options for a car, it can be confusing. In general, an "option" refers to an adapter board you can buy for installation inside the system unit.

Color-Graphics Video. The color-graphics adapter board provides outputs for a high-resolution graphics monitor or for an RF (radio-frequency) modulator to connect to a television set. The adapter also includes a light-pen interface. (A light pen lets you communicate with the computer by touching the pen to the display.) However, IBM does not provide the color display, RF modulator, or light pen. It's up to the computer retailer and you to obtain these devices and the cables to connect them.

With a high-quality color display, the Personal Computer is capable of dazzling graphics. Even using a television set, the results are apt to be better than you'd get using any other American personal computer. The only close competition comes from a few Japanese personal computers.

Up to 16 foreground and 8 background colors are available when displaying text and character graphics. The screen holds 25 lines of 40- or 80-character text. In the text mode, the

When comparing the Personal Computer to other "color computers," it's worth noting that the IBM's screen memory is separate from user memory. The color-graphics adapter board includes 16K bytes of memory for this purpose. (The same holds true for the monochrome adapter, which has 4K bytes of screen memory.) With many other personal computers, video memory is taken out of the precious 64K bytes of total address space.

Printer. IBM has repackaged the popular Japanese-made Epson MX-80 for use with the Personal Computer. This 80-character-per-second dot-matrix printer produces very readable but not letter-quality results, and it can reproduce all of the text and graphics characters of the display (but not dot-graphics).

A printer adapter is required to connect the IBM printer. The monochrome-display adapter includes the printer adapter, but if you have only the color-graphics adapter you'll have to add the printer adapter. It costs a little more this way and ties up an extra expansion slot in the system unit. The adapter uses the common Centronics

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parallel interface, so it should be no problem to connect any of a multitude of printers to the Personal Computer.

One nice (but not unique) feature of the Personal Computer is the ability to copy the screen contents (text screen only) to the printer at any time, simply by pressing a special key on the keyboard.

Disk Drives. The system unit is designed to accommodate up to two built-in floppy-disk drives. The drives are the double-density, 5¼-inch type, with a total storage of 160K bytes per disk. To use disks, you must also add the disk-controller adapter.

IBM's system is considerably faster than the 5¼-inch disk systems in other personal computers because it transfers data directly to and from memory. The main microprocessor doesn't have to control every detail of the transfer process.

Other Options. For serial communications and control of compatible devices, an asynchronous adapter is available. This allows connection of RS-232C and current-loop compatible devices (modems and printers, for example). A game-control adapter allows connection of two joysticks or four game paddles for inputting positional information in games or other applications. It's up to you and the retailer to obtain compatible devices and connecting cables to use with both the asynchronous adapter and the game-control adapter.

Software

The Personal Computer comes with a great deal of built-in software in its 40K bytes of ROM. About 8K bytes of ROM are devoted to fundamental I/O (input/output) software for *all* devices—standard and optional. The remaining 32K bytes of ROM contain the cassette BASIC interpreter from Microsoft. This code also becomes the core for the two step-up BASICs—Disk BASIC and Advanced BASIC, also from Microsoft.

Cassette BASIC includes all the extended features of Microsoft BASIC, plus commands to store and load programs and data on cassette tape, create dot graphics, and output sounds through the built-in speaker.

Writing your own programs with IBM BASIC is especially convenient. An important feature of the language is its keyphrase capability. Instead of typing in BASIC keywords, you can press the Alt key followed by a letter key; for example, Alt-P generates the oft-used keyword PRINT. Once you learn this abbreviated method, it really saves time.

Another time saver is the screen-oriented editor. You can change any line on the screen by moving the cursor to the desired place, making the insertion or deletion, and pressing Enter. With the line-oriented editors on most BASICs, you can only edit the "current line."

IBM offers Disk BASIC together with the IBM DOS (described below) on a 5¼-inch disk. To the features of cassette BASIC, Disk BASIC adds programming tools for disk and communications I/O (the latter requires installation of the communications adapter).

Advanced BASIC is an enhanced form of Disk BASIC. It offers several extremely powerful programming tools: DRAW and PAINT make graphic programming easy; PLAY generates melodies that you program using a special notation; PEN and ON PEN GOSUB allow use of the light pen; ON KEY GOSUB allows any key to interrupt a program; ON COM GOSUB allows the communications adapter to interrupt a program. With a little experience in BASIC programming, you should be able to put together some applications that would require advanced machine-language programming on other personal computers.

All disk-based software requires some form of a disk operating system (DOS). That's why Disk BASIC and Advanced BASIC are provided on a disk with IBM's DOS. It provides a more sophisticated control of the computer than is available through the cassette-based system and offers a command interpreter that lets you perform essential disk operations like copying disk files, initializing disks, renaming files, checking the contents of a disk, and storing and retrieving the time and date.

Another important function of a DOS is to provide a standard interface for applications programs. This facilitates the transportation of popular programs from one computer model to another. In the 8-bit microprocessor world, the CP/M operating system performs such a function. Any computer that can run CP/M is automatically capable of running a myriad of proven applications programs. Many observers expected CP/M-86 (the 16-bit descendant of CP/M) to be in the driver's seat of the IBM and other 16-bit computers.

However, it now appears that the IBM DOS may preempt that role. Lifeboat Associates, the software vendor that handled CP/M during its rise to preeminence, has placed its mark of approval on the IBM DOS and sells it as SB-86. While this battle of DOSes sounds technical, it will be very important to consumers, because it will determine how much existing applications software will be available for the Personal Computer, and how soon.

When IBM introduced the Personal Computer, enough software was available to make the system usable right away. Included were the ever-popular Visicalc "electronic spreadsheet," Easywriter (a word-processing program), an accounting system from Peachtree Software, and Microsoft's version of the well-known Adventure game. As this article went to press, several new software packages were also announced.

The IBM Personal Computer Education Program Series offers a number of programs for students. Fast Track (from SRA, a company owned by IBM) helps students learn basic arithmetic skills. Arithmetic Games Sets 1 and 2 are designed to refine math skills by using games. Also available is Typing Tutor from Microsoft, a touch-typing instruction and drill program.

The Business Programs Series has a new addition—General Accounting from BPI Systems is designed for a small-business or professional environment.

For advanced programmers, the Computer Language Series has two new additions, including an assembler (to program the computer in machine

New from NRI!
The first at-home training in videocassette recorder repair with exclusive videotaped lessons.

Learn Video/Audio Servicing…includes RCA state-of-the-art VCR, NRI Action Video lessons, plus full training in color TV and audio repair.

Now, you can learn the hottest, most wanted skill in home entertainment electronics… servicing and repairing videocassette recorders and video disc players. Well over 2 million units have already been sold and the demand is just starting! Already, qualified VCR technicians are in short supply…people are waiting up to a month for VCR repair. Good jobs at good pay are going begging. And NRI can get you in on the action with convenient and effective at-home training.

Choice of Specialized Training

NRI offers you three Master Courses in Video/Audio Servicing, each complete, each with equipment and training for the specialty you want. Each course thoroughly prepares you for color TV plus audio and video equipment. Then, you take the specialized hands-on training on the equipment you select.

Learn as you work with equipment you keep.

You can get specialized audio experience as you build your own AM/FM stereo system complete with speakers. Or gain real bench experience with hands-on TV training as you build a 25" (diagonal) fully-computerized, programmable color TV and professional test instruments. Or train with your own RCA videocassette recorder and NRI's exclusive Action Video servicing lessons on videotape.

State-of-the-Art VCR

This modern VCR features high-technology design with electronic pushbutton tuning, remote control, three recording speeds with up to 6-hour capacity, high-speed visual search, built-in clock/timer, memory rewind and audio dubbing capability. Direct drive motors and azimuth recording give outstanding picture reproduction.

It's yours to keep, as part of your training. You'll not only use it to learn operation and servicing techniques, but to play the absorbing NRI Action Video lessons that come as part of your specialized training. In word and picture, you'll learn theory, construction, and service procedures, see them explained in graphic closeups. And you get this unique training only with NRI!

Learn at Home at Your Convenience

No need to quit your job or tie up your evenings at night school. No time away from your family or expensive travel. NRI comes to you. You are a class of one, getting both theory and practical hands-on training backed up by our staff of experienced educators.

NRI the Pros' Choice

More than 65 years and a million and a half students later, NRI is still the first choice in home-study schools. A national survey of successful TV repairmen shows that more than half have had home-study training, and among them, it's NRI 3 to 1 over any other school.

That's because you can't beat the training and you can't beat the value. Only NRI combines exclusive fast-track training techniques with modern state-of-the-art equipment to give you the skills you need for success quickly and easily. Only NRI offers such complete training with so many timely options for specialized bench experience. Send for our free catalog and get all the facts on these exciting Master Courses in Video/Audio servicing.

Free Catalog… No Salesman Will Call

Mail the postage-paid card today for your free copy of our 100-page look into tomorrow. It shows all the equipment you get, describes each lesson in detail. And it tells you about other important career opportunities in Microcomputers and Microprocessors, Digital and Communications Electronics, Electronic Design Technology, and more. Send today and get started on a big new future for yourself. If card has been removed, please write to us.

NRI McGraw-Hill

NRI SCHOOLS
McGraw-Hill Continuing
Education Center
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Washington, D.C. 20016

We'll give you tomorrow.

177-032

Fill this space with a GRAFTRAX graphic and win a trip to Japan.

The Epson "Softwear" Sweepstakes.

We're looking for the Picasso of programming. So we drew up an art contest for people who don't know a painting pallet from a PROM.

If you've got an Epson printer, a computer and a little imagination, you could win a week-long trip for two to Japan. Or our top-of-the-line 136-column MX-100 printer. Or his and hers Seiko Quartz Watches. Or a whole lot of honorable mention prizes. And you'll get a T-shirt with the winning graphic just for entering.

All you have to do is program a GRAFTRAX graphic — abstract, landscape, still life, whatever — using an Epson MX-70, MX-80, MX-80 F/T or MX-100 printer. We'll not only put it on our T-shirts, we'll be displaying the winning entries for all to see in June at the National Computer Conference in Houston.

Why, you may ask, are we being so generous? It's simply because GRAFTRAX is the most incredible graphics capability made for micros. And we want to see it used to its full potential.

All entries will be judged on originality, creativity and best use of computer equipment. They must be postmarked no later than May 1, 1982, and be accompanied by the software program, so we can recreate the winning entries for verification. Make sure the graphic is no larger than 8" x 10" and no smaller than 4" x 6". And remember, if you digitize art or a photograph, it must have been originally created by you.

So get busy and enter. You might be a winner.

And your software could be your "softwear."

EPSON
EPSON AMERICA, INC.

3415 Kashiwa Street • Torrance, California 90505

EPSON "SOFTWEAR" SWEEPSTAKES RULES

1) Any computer equipment may be used to format the entry, but the graphics output must have been printed on an Epson MX-70, MX-80, MX-80 F/T or MX-100 printer with either built-in or optional GRAFTRAX. Winning entries will be re-created by Epson for verification.

2) Each entry must be accompanied by the software program used to create it. All entries and software and the rights to use them become the property of Epson America, Inc.

3) All entries must be at least 6"x 4" and no larger than 8"x 10" in size.

4) Art or photographs, if used, must have been created by the entrant.

5) All entries will be judged by an independent panel of judges on their creative merit, originality and best use of computer equipment. Decision of the judges is final.

6) This contest is valid from January 1, 1982 until May 1, 1982. Entries must be postmarked no later than May 1, 1982.

7) Participation in the Epson "Softwear" Sweepstakes is open to any except the following: employees of Epson America, Inc., its service agencies, or their families.

8) Winners will be notified by mail no later than June 1, 1982. A list of winners will be made available by sending a stamped, self-addressed envelope to Epson America, Inc., 3415 Kashiwa Street, Torrance, CA 90505.

9) Entries will be maintained on file at Epson America, Inc. until January 1, 1983.

10) Prizes are as follows: First prize includes round-trip economy air transportation for two to Tokyo, from the airport nearest the winner's place of residence, and six nights standard hotel accommodations, double occupancy. Trip does not include airport departure taxes, hotel service charges, cost of transportation or other expenses incurred before leaving the airport of initial departure, returning to Tokyo airport and returning home from the airport of initial departure; nor does it include meals or gratuities. Second prize consists of one Epson MX-100 Printer. Third prize consists of his and hers Seiko Quartz Watches. Additional prizes include 25 Micro-Nine Printheads, 50 Epson Digital Watches, and 100 Epson Ribbon Cartridges.

11) You may enter more than once, but each entry must be accompanied by the official entry coupon below.

12) Void where prohibited by law.

Attach this form firmly to the back of each graphic you enter.

NAME _____

STREET _____

CITY _____

STATE _____ ZIP _____

PHONE (_____) _____

COMPUTER EQUIPMENT USED

_____

_____

PRINTER MODEL AND SERIAL NUMBER

_____

_____

T-SHIRT SIZE ____S ____M ____L ____XL

Mail entries to:
"SOFTWEAR" SWEEPSTAKES
Epson America, Inc.
3415 Kashiwa Street
Torrance, California 90505

EPSON
EPSON AMERICA, INC.

	Home System	Deluxe Home System	Office System
Apple II or II Plus	$1370	$3085-$3185	$4280
Atari 400	$500-$630	—	—
Atari 800	$1080-$1280	$2750	$4450
Commodore VIC-20	$300-$400	$1380	—
Commodore CBM	$995-$1495	$3120	—
IBM Personal Computer	$1605	$4090	$4835-$5465
TRS-80 Color Computer	$400-$600	$1895	—
TRS-80 Model III	$700-$1000	$2995	$4355-$5455
TI 99/4A	$575	$2225	—

Table 1: A comparison of system prices, including manufacturer-supplied hardware. This table is not for "comparison shoppers"; it merely illustrates approximate price ranges. See the text for an explanation of the system categories.

language) and FORTRAN, a scientific language familiar to anyone who's used a large computer.

But this list is only the beginning. P. D. Estridge, director of the IBM Personal Computer marketing program, says other soon-to-be-released programs will make the unit "the most useful system of its kind."

Should You Buy It?

Back to our original question. IBM is a standout among personal computers. But what about cost-effectiveness?

That depends on exactly what you're going to use the computer for. For the sake of comparison, let's look at three typical configurations and see how the IBM fares against other personal computers.

- *The home computer system, starter version.* This gets your family into personal-computing applications such as games, education, and record-keeping. The computer has 4 to 16K bytes bytes of user memory and is connected to the household television set and tape recorder.
- *The home computer system, deluxe version.* This is for a family that really wants to make serious use of the computer. They will need several extra components, such as 32 to 48K bytes of memory, serial communications interface for use with information utilities, a printer for hard copy of records and word-processing efforts, and one disk drive for efficient program and data storage.
- *Office system.* This configuration allows word processing, accounting, and use by managers for decision-making. The computer has 64 to 128K bytes of memory; a monochrome display, two to four disk drives; a printer, and a serial communications interface.

Looking at table 1, you'll notice that the IBM Personal Computer is most competitive in the last two categories. The more power you want, the better the IBM looks.

This reasoning is reflected in actual sales at Computerland stores. According to Marian Murphy, Computerland's vice president of operations, the most commonly purchased system consists of two drives, monochrome display, printer, and applications software.

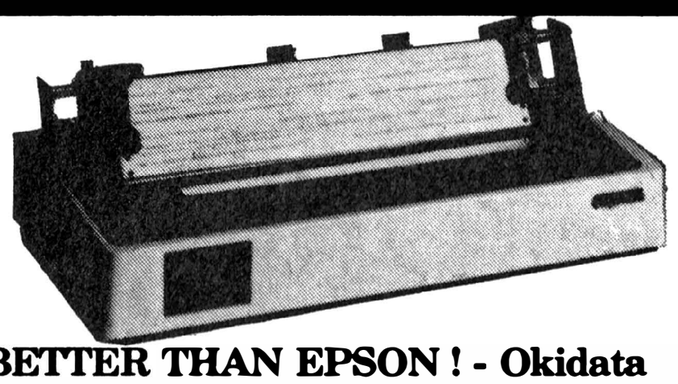
No, IBM hasn't blown away the little guys. It hasn't made things easier for the computer shopper, either. Now there's one more computer that you've *got* to see before making your decision. One final suggestion. Pay extra close attention to this one. It deserves it. □

George Stewart is senior editor of Popular Computing.

JADE Computer Products

Sunnyvale • Woodland Hills • Hawthorne • San Diego

Printers



BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column, 120 CPS, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082 *with FREE tractor* **$544.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A.*

PRM-43083 *with FREE tractor* **$774.95**

Microline 84 *132/232 column, 200 CPS, full dot graphics built in, handles forms up to 15" wide, plus all the features of the 83A.*

PRM-43083 *with FREE tractor* ... **$1249.95**

PRA-27081 *Apple card* **$39.95**
PRA-27082 *Apple cable* **$19.95**
PRA-27087 *TRS-80 cable* **$24.95**
PRA-43081 *Hi speed 2K serial board* **$169.95**
PRA-43080 *Extra ribbons pkg. of 2* ... **$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070 *List $459* **$399.95**

MX-80 *80 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080 *List $645* **$469.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082 *List $745* **$559.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100 *List $945* **$759.95**

PRA-27084 *Serial interface* **$69.95**
PRA-27088 *Serial intf & 2K buffer* .. **$144.95**
PRA-27081 *Apple card* **$74.95**
PRA-27082 *Apple cable* **$22.95**
PRA-27086 *IEEE 488 card* **$52.95**
PRA-27087 *TRS-80 cable* **$32.95**
PRA-27085 *Graftrax II* **$95.00**
PRA-27083 *Extra ribbon* **$14.95**

Modems

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A *Smartmodem* **$249.95**
IOK-1500A *Hayes Chronograph* ... **$199.95**

CAT MODEMS - Novation

CAT *300 baud, acoustic, answer/orginate*

IOM-5200A *List $189.95* **$149.95**

D-CAT *300 baud direct connect, answer/orginate*

IOM-5201A *List $199.95* **$169.95**

AUTO-CAT *Auto answer/orginate, direct connect*

IOM-5230A *List $299.95* **$239.95**

Apple-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

IOM-5232A *Save $50.00!!!* **$325.00**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K *TRS-80 kit* **$25.00**
MEX-16101K *Apple kit* **$25.00**
MEX-16102K *Exidy kit* **$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A *Save $70.00 !!!* **$129.95**

Z-80* CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*

CPX-30800A *A & T* **$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A *A & T* **$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package *(Kit)* **$1495.00**
1 MegaByte Package *(A & T)* **$1695.00**
2 MegaByte Package *(Kit)* **$1795.00**
2 MegaByte Package *(A & T)* **$1995.00**

DISK DRIVES - Micro Sci

Inexpensive disk drives for your Apple

A2 *Direct replacement for Apple Disk II, works with Apple II controller as first or second drive.*

MSM-123101 *Micro Sci A2* **$429.95**

A40 *40 track drive for Apple II. Improved storage capacity and speed over Apple Brand drives - requires Micro Sci controller.*

IOD-2340A *Micro Sci A40* **$399.95**

A70 *70 track drive for Apple II. Twice the storage capacity and three times faster than Apple Brand drives - requires Micro Sci controller*

IOD-2370A *Micro Sci A70* **$499.95**

Micro Sci Controller *Disk controller for up to two Micro Sci A40 or A70 disk drives, DOS 3.2, 3.3, Pascal, and Z-80 SoftCard compatible, includes utility disk and 40/70 track patch.*

IOD-2300A *Micro Sci controller* **$95.00**

VISION 80 - Vista Computer

80 column x 24 line video card for Apple II, 128 ASCII characters, upper and lower case, 9 x 10 dot matrix with 3 dot descenders, standard data media terminal control codes, CP/M Pascal & Fortran compatible, 50/60 Hz

IOV-2400A *Vista Vision 80* **$375.00**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K *Par & Ser kit* **$139.95**
IOI-2050A *Par & Ser A & T* **$169.95**
IOI-2052K *Serial kit* **$89.95**
IOI-2052A *Serial A & T* **$99.95**
IOI-2054K *Parallel kit* **$69.95**
IOI-2054A *Parallel A & T* **$89.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A *A & T* **$199.95**

Single Board Computer

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook

CPS-30100K *KIT* **$299.95**
CPS-30100A *A & T* **$469.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 4K of ROM, key-pad, LED display, 20ma & cassette interface on board.

CPK-50020A *A & T* **$249.95**

VIC 20 - Commodore

Complete personal computer with 5K RAM, full color, 61 key keyboard, 4 dual special-function keys, serial ports, cassette port, composite video output (connects to standard color TV set), BASIC language, & expansion port.

COM-VIC20 *VIC-20* ..... **Under $300.00**

PERSONAL COMPUTERS

Also available from Jade - Call for Price and Info

AIM-65, Altos, Apple II, Atari, Commodore, California Computer Sys Hewlett-Packard, Intersystems Jade, NEC, Novell, SD Systems SYM-1, Xerox, and more...

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201 *List price $150.00* **$118.95**

12" GREEN SCREEN - NEC

20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

VDM-651200 *Special Sale Price* **$199.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212 *Color Monitor* **$479.95**

NEC-1202D *RGB color monitor* ... **$1045.00**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210 *Video 100 12" B&W* .. **$139.95**
VDM-801230 *Video 100-80 12" B& W* **$179.95**
VDM-801250 *12" Green Phospor* **$169.95**
VDC-801310 *13" Color I* **$379.95**
VDC-801320 *Color II* **$895.00**
IOV-2300A *DVM board for Apple* .. **$199.95**

Video Terminals

TELEVIDEO 910

Full featured - inexpensive terminal

VDT-901210 *List 795.00* **$695.00**

TELEVIDEO 950

VDT-901250 *List $1195.00* **$995.00**

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 dot matrix, 10 program function keys, 14 key numeric pad, 12" non-glare screen, 50 to 19,200 baud, direct cursor control, auxiliary bi-directional serial port

VDT-351200 *List $795.00* **$645.00**

VIEWPIONT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display,

VDT-501210 *Sale Priced* **$639.95**

DIALOGUE 80 - Ampex

VDT-230080 *List $1195.00* **$895.00**

SD Systems ExpandoRAM III

256K RAM $879.95

Single User System

SBC-200, 64K ExpandoRAM II, Versafloppy II, CP/M 2.2

$995.00

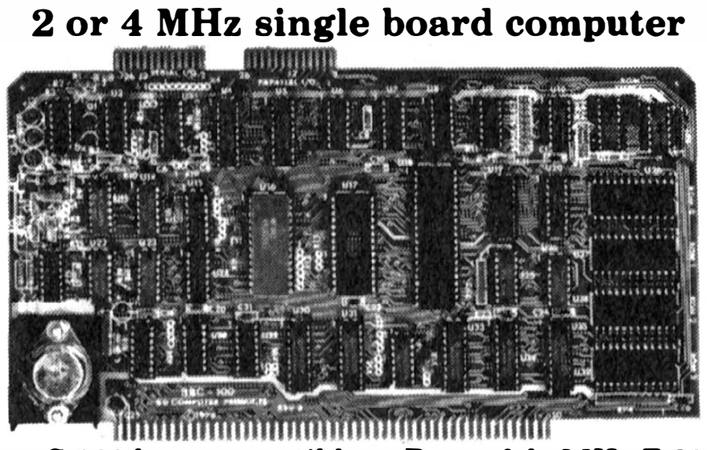
4 MHz Z-80A CPU, 64K RAM, serial I/O port, parallel I/O port, double-density disk controller, CP/M 2.2 disk and manuals, system monitor, control and diagnostic software.

Add $100.00 for upgrade to ExpandoRAM III 64K (expandable to 256K)

-All boards are assembled and tested-

SBC-200

2 or 4 MHz single board computer



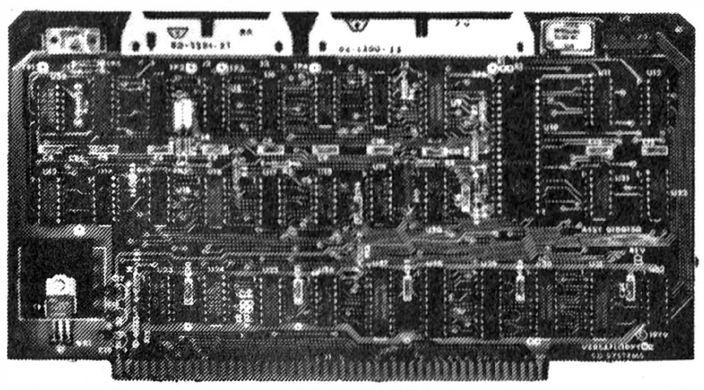
• S-100 bus compatible • Powerful 4MHz Z-80A CPU • Synchronous/asynchronous serial I/O port with RS-232 interface and software programmable baud rates up to 9600 baud • Parallel input and parallel output port • Four channel counter/timer • Four maskable, vectored interrupt inputs and a non-maskable interrupt • 1K of on-board RAM • Up to 32K of on-board ROM • System monitor PROM included

The SBC-200 is an excellent CPU board to base a microcomputer system around. With on-board RAM, ROM, and I/O, the SBC-200 allows you to build a powerful three-board system that has the same features found in most five-board microcomputers. The SBC-200 is compatible with both single-user and multi-user systems.

CPU-30200A *A & T with monitor* . **$299.95**

Versafloppy II

Double density controller with CP/M 2.2



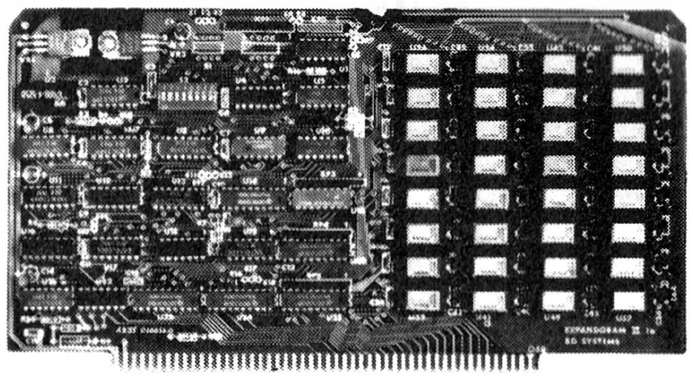
• S-100 bus compatible • IBM 3740 compatible soft sectored format • Controls single and double-sided drives, single or double density, 5¼" and 8" drives in any combination of four simultaneously • Drive select and side select circuitry • Analog phase-locked loop data seperator • Vectored interrupt operation optional • CP/M 2.2 disk and manual set included • Control/diagnostic software PROM included

The Versafloppy II is faster, more stable and more tolerant of bit shift and "jitter" than most controllers. CP/M 2.2 and all necessary control and diagnostic software are included.

IOD-1160A *A & T with CP/M 2.2* .. **$370.00**

ExpandoRAM III

64K to 256K expandable RAM board



SD Systems has duplicated the famous reliability of their ExpandoRAM I and II boards in the new ExpandoRAM III, a board capable of containing 256K of high speed RAM. Utilizing the new 64K x 1 dymanic RAM chips, you can configure a memory of 64K, 128K, 192K, or 256K, all on one S-100 board. Memory address decoding is done by a programmed bipolar ROM so that the memory map may be dip-switch configured to work with either COSMOS/MPM-type systems or with OASIS-type systems.

Extensive application notes concerning how to operate the ExpandoRAM III with Cromemco, Intersystems, and other popular 4 MHz Z-80 systems are contained in the manual.

MEM-65064A *64K A & T* **$495.00**
MEM-65128A *128K A & T* **$639.95**
MEM-65192A *192K A & T* **$769.95**
MEM-65256A *256K A & T* **$879.95**

ExpandoRAM II

16K to 64K expandable RAM board

• S-100 bus compatible • Up to 4MHz operation • Expandable from 16K to 64K • Uses 16 x 1 4116 memory chips • Page mode operation allows up to 8 memory boards on the bus • Phantom output disable • Invisible on-board refresh

The ExpandoRAM II is compatible with most S-100 CPUs. When other SD System' series II boards are combined with the ExpandoRAM II, they create a microcomputer system with exceptional capabilities and features.

MEM-16630A *16K A & T* **$325.00**
MEM-32631A *32K A & T* **$345.00**
MEM-48632A *48K A & T* **$365.00**
MEM-64633A *64K A & T* **$385.00**

Multi-User System

SBC-200, 256K ExpandoRAM III, Versafloppy II, MPC-4 COSMOS Multi-User Operating System, C BASIC II

$1995.00

Two Z-80A CPUs (4 MHz), 256K RAM, 5 serial I/O ports with independently programmable baud rates and vectored interrupts, parallel input port, parallel output port, 8 counter/timer channels, real time clock, single and double sided/single or double density disk controller for 5¼" and 8" drives, up to 36K of on-board ROM, CP/M 2.2 compatible COSMOS interrupt driven multi-user disk operating system; allows up to 8 users to run independent jobs concurrently, C BASIC II, control and diagnostic software in PROM included.

-All boards are assembled and tested-

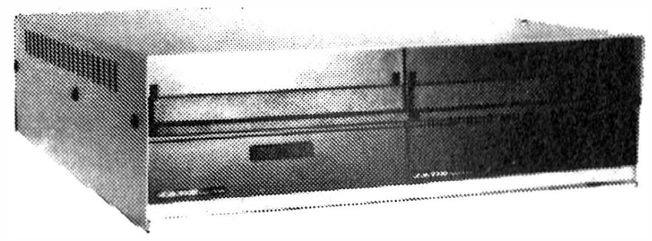
8" Disk Drives

Shugart SA801R *single-sided double-density*
MSF-10801R .. $394.95 ea 2 for **$389.95 ea**

Shugart SA851R *double-sided double-density*
MSF-10851R .. $554.95 ea 2 for **$529.95 ea**

Qume DT-8 *double-sided double-density*
MSF-750080 .. $524.95 ea 2 for **$499.95 ea**

Siemens FDD 100-8 *sngl-sided dbl-density*
MSF-201120 .. $384.95 ea 2 for **$349.95 ea**



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The Radio Shack TRS-80 Pocket Computer

by Theresa Welsh

The Radio Shack TRS-80 has a baby brother, a small computer that fits in your hand. By now you've probably seen the new Pocket Computer and wonder if it's just a clever toy. I've had one now for two months, and in that time have gotten to know it pretty well. Tiny as it is, this TRS-80 compares favorably with its larger relatives.

Buying the Pocket Computer made us a two-computer family since we already had a TRS-80 Model I with all the accessories. We acquired our equipment to help us in our photo business. Later, my husband David began writing commercial software. However, the fast move from Level 1 BASIC to Level 2 BASIC to Disk BASIC always left me a little behind. And frankly, I never worked up any ardor for a machine that is an octopus of wires and cables, doesn't easily fit on a home desk (along with everything else), and is always surrounded by a clutter of disks and printouts. So, David thought the Pocket Computer would be a good choice for me.

Theresa Welsh is a freelance writer living in Detroit.

I rapidly mastered the commands available for the Pocket Computer, and it's become a very comfortable friend. I already have twelve working programs, which I produced painlessly, never once being tempted to smash the keyboard (an act of violence I've had to keep my husband from committing numerous times on our big TRS-80). Instead of a big monster, it is a small, sleek piece of shiny metal, with a keyboard so tiny you *must* hunt and peck on it. This product is what the computer industry has lacked: a nonintimidating and truly portable computer. After the last meeting of our local computer club, while everyone else carted out heavy boxes of equipment, I simply stuffed my computer in my purse.

The Pocket Computer, unlike programmable calculators with memories, uses a form of BASIC similar to TRS-80 Level 1 BASIC. In some ways it's actually better. Editing programs is easier because the machine has its own editor. A blinking cursor moves across the liquid-crystal display when you press arrow keys; you simply overtype mistakes. There are even "insert" and "delete" keys that let you alter program lines. By placing the cursor at the beginning of a line and overtyping a new line number, you can move that line to any part of the program. You then delete the old line number or reuse it.

The most limiting factor of this machine is the small display screen—only 24 characters. However, you can store up to 80 characters on a program line. When you enter the 25th character, the screen begins to scroll and the first character disappears. The cursor moves the display, showing the part that's off the screen. Up and down arrow keys are used to move from one program line to another.

Not Perfect

While all this is remarkable for a computer so small, the Pocket Computer is not perfect. When you make corrections to a program line, then hit "enter" to make them permanent, the screen vanishes for what seems like a

The TRS-80 printer cassette interface prints all input transactions on paper tape.

long time (actually, it *is* a long time!). When it comes back, the beginning of the line is displayed, not the part you were working on. You have to scroll back to the part of the line you fixed if you want to see it again. Then you have to hit "enter" again before you begin the next program line, or you'll find you've typed over the last line. Also, in inserting or deleting, if you're working on a part of the line beyond the 24-character normal display, moving the cursor to the character where you wish to insert or delete makes that character the last one displayed. This means you can't see the characters beyond this one until you do the delete/insert, when the display moves to the next character.

The limited display creates problems in writing programs. All prompts, instructions, and answers must fit in the 24-character display. You end up devising ingenious abbreviations for things (like "no. of payments/yr?"). A related problem is that Pocket Computer BASIC allows only 7 characters in a string variable (a large number or word that changes during the program). If you want to store words as strings, they better be short! Fortunately, there is no limitation on the number of characters you can use in PRINT statements. The memory is organized much like a programmable calculator—it allows 1424 steps.

In comparing Pocket Computer BASIC to other BASICs, the small computer does not have DATA statements or multidimensional arrays. Also, it lacks ON...GOTO and ON...GOSUB. Programs that store large amounts of data are not practical. On the plus side, you can name subroutines. For example, since Pocket Computer BASIC has no built-in random-number generator, a subroutine to generate random numbers can be named RND and called up by GOSUB "RND".

Too Fast, Too Slow

When you run a program on the Pocket Computer, execution stops after each PRINT statement. You then have to press "enter" to continue. For continuous execution, a command called PAUSE works like PRINT, but flashes the words on the screen briefly, a bit too briefly in some cases. I use PAUSE with BEEP, a command that sounds a tone, to flash program instructions on the screen, but you have to be alert or you'll miss them (the "beeps" keep you alert!). While PAUSE is a bit too fast, execution is often a bit too slow. If you're used to a larger computer, you become impatient waiting for the computer to finish "thinking."

One of the nicest features of the Pocket Computer is that you won't lose your programs even if you turn the computer off. When you turn it back on, your programs are still there. You can't lose a program line unless you key in that line number, then press "enter." You clear out the whole memory with NEW. This computer is very handy for someone using the same programs over and over since they are never lost from memory. If you want to use a variety of programs, Radio Shack sells a cassette interface that can be used with any cassette recorder to save programs on tape.

Looks for Faulty Logic

For math freaks, the Pocket Com-

cut me out

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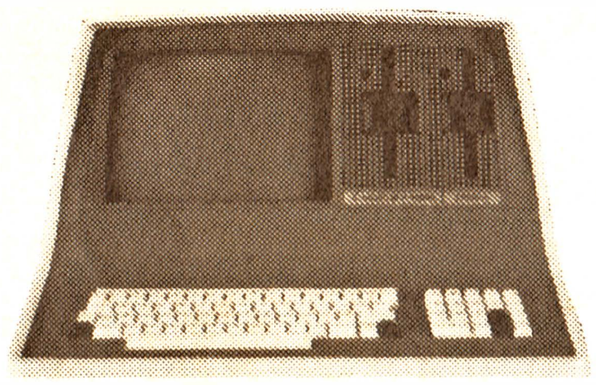

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Popular Reviews: Hardware

Radio Shack's cassette interface. When used with any cassette recorder, it allows you to use several programs and preserve them on tape.

puter is much better than the TRS-80 Level 1 machine. The small computer performs all trigonometry functions with built-in commands. It has keys for square root and exponentiation. It allows using keys as custom commands by programming them individually and running the programs in a special DEFinable mode. For people like me who want to write BASIC programs, a DEBUG command runs the program and displays the line number just executed. This helps track down the faulty logic that is the usual cause of faulty programs. The Pocket Computer also has six error codes, each one representing a different kind of error. To help you even more, when an error code is displayed while your program is executing, pressing the down-arrow key displays the program line that is at fault, and the cursor is on the part of the line where the error is. This is a great help for the fledgling programmer.

While the Pocket Computer is easy to program, it wasn't designed with the beginner in mind. Its manual is fairly complete, but does not include tutorial material for those who don't know BASIC. The BASIC is a bit different from standard, especially in the way the memory works; so if you're a beginning programmer, keep this in mind if you consult textbooks on BASIC. For anyone familiar with BASIC, learning to use the Pocket Computer is easy.

Numbers—Not Words

The Pocket Computer can also be used as a sophisticated calculator. Its numerical functions exceed those of most calculators, and it will display long computations on its screen. You can even key in a long calculation, get the answer, display the calculation again, use the cursor to edit the calculation to something new, and get a new answer. Obviously, this machine was built more with numbers in mind than words.

It seems unlikely that the Pocket Computer will ever have the large array of add-on hardware currently available for most home computers. But in addition to the tape interface, a printer is now available. Unfortunately, the Pocket Computer cannot be used with a larger computer; programs run on it cannot be loaded into the big TRS-80. Neither the hardware nor the software is compatible.

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Intention–Small

The dearth of extras *does* insure that the Pocket Computer will be used as intended–as a portable computer. Its portability means you can enjoy it wherever you are–at your desk or job site, on the bus, or in bed. It fits into a briefcase or a drawer. For all its good points, this tiny TRS-80 may not appeal to hard-core computer fiends who need an endless supply of peripheral devices to fuel their habit. The Pocket Computer does what it does quite well; but what it does *is* limited. If you have no interest in storing an encyclopedia or shooting down spaceships, and you appreciate a system that costs less than $230, the Pocket Computer may be for you.

Product Information

The Radio Shack TRS-80 Pocket Computer sells for $229.95. The cassette interface (for loading programs from tape) is $49. The cassette interface with a built-in printer is $149.95. For more information, contact:

Radio Shack
1300 One Tandy Center
Fort Worth, TX 76102
(817) 390-3011

(See page 42 for reviews of two of the eight software packages sold by Radio Shack for the Pocket Computer.)

Other Pocket Computers

A pocket computer virtually identical to the Radio Shack TRS-80 Pocket Computer is sold by:

Sharp Electronics Corp.
10 Keystone Pl.
Paramus, NJ 07652
(201) 265-5600

Casio has also announced a pocket computer, the FX-702P. It has a number of advanced features, including the ability to hook up to a tape recorder without a separate interface. The memory capacity can also be increased with optional packages. The FX-702P sells for $199.95. For more information, contact:

Casio Inc.
15 Gardner Rd.
Fairfield, NJ 07006
(201) 575-7400

Listing 1: A unique Pocket Computer program working with voice input. The answers provided by the computer bear no relationship to the question asked. Just ask any question that can be answered "yes" or "no." The program chooses from a series of answers in PRINT statements. The choice is made by use of a random-number-generating formula that picks a number from 1 to 12 (the number of answers provided). The computer doesn't "know" the answer to your question, but you don't know which answer it will choose either, which is what makes this one so much fun.

```
5 PAUSE "FORTUNE TELLER": BEEP 1
10 INPUT "ASK QUESTION"; A$
20 GOSUB "RND": T = Y + 400
25 GOSUB T:GOTO 5
85 GOTO 5
89 REM SUBROUTINE
90 "RND": Z = 0
100 X = B – INT(B/E)*E
135 Y = INT(X/12): Y = Y * 12: Y = X – Y
140 RETURN
400 PRINT "YES":RETURN
401 PRINT "NO": RETURN
402 PRINT "MAYBE": RETURN
403 PRINT "YOU BET":RETURN
404 PRINT "THE FUTURE IS CLOUDY": RETURN
405 PRINT "ABSOLUTELY": RETURN
406 PRINT "ABSOLUTELY NOT":RETURN
407 PRINT "GO AWAY, DUMMY": RETURN
408 PRINT "THINGS LOOKED MIXED":RETURN
409 PRINT "OUTLOOK IS BRIGHT": RETURN
410 PRINT "OH, YES": RETURN
411 PRINT "NOT ON YOUR LIFE": RETURN
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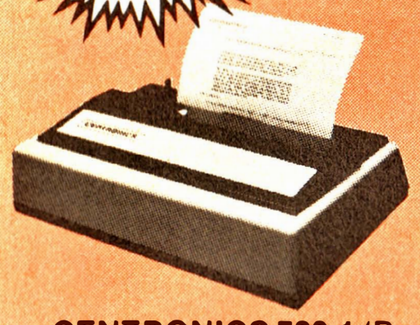

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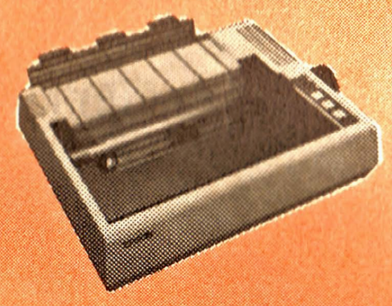

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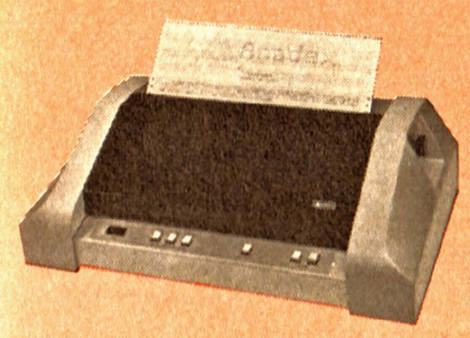

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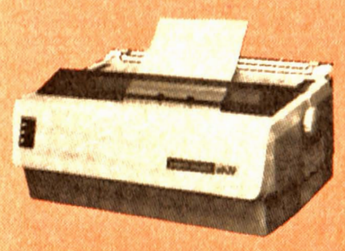

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Radio Shack sells eight software packages for its TRS-80 Pocket Computer. The programs range from games to civil engineering to business and personal financial applications. Radio Shack has made efficient use of programming techniques to pack a lot of information into a small memory space. Following are reviews of two of the software packages: Personal Finance and Aviation.

Personal Finance

by Rich Friedman

Your excuses for not having an up-to-date balanced checkbook just ran out. Even though programs to balance checkbooks are as ubiquitous as ice-cream cones, Radio Shack now offers the first really practical way to enter the amount of checks you write at the time you write them.

Electronic Checkbook, one of five home money-management programs in Radio Shack's Personal Finance package, takes the drudgery and guesswork out of checkbook reconciliation. Each time you write a check, you punch the relevant information into your trusty Pocket Computer, and, presto, you have a running total of all checks you've written to a total of twenty. (Once you reach twenty you copy in your checkbook and start over again.)

The program lets you enter the check number, date, what the check was for, and the amount. On the credit side, the Pocket Computer records deposits that are automatically added to your last balance.

Now comes the clever part: at the press of a single key, you can check your current balance and review recent transactions (again, only up to twenty checks). The Pocket Computer tells whether you are "IN AGREEMENT" with the bank's monthly statement. If the amounts do not balance, it asks if you have (service charge) or "INTEREST?" payment. Then, without making value judgments, the Pocket Computer tells how much you are over or under.

Once you have a balanced checkbook, it's a natural progression to try to keep your house in order with a yearly budget. Radio Shack's Budget Management program lets you compare actual monthly expenses against budgeted ones and gives you year-to-date totals for each category you establish. Each month you save your monthly expenses on a cassette tape.

The third program in the Personal Finance package concerns interest and annuities. If, after establishing a budget, you find that you have cut your impulse buying sprees and have a few dollars to invest, this program helps you figure the future value terest, and effective yield. In short, where to get the best return for your money.

If the stock market has more appeal to you than money market funds, the Value of Stocks program lets you store the following information for up to nineteen stocks: stock name, number of shares owned, and value per share. Program options let you add stocks to your portfolio, change the number of shares for any stored stock, obtain the value of each individual stock, obtain the value of your total portfolio, adjust the value per share for each stock, and write your stock information to a tape data file to be read when needed.

The fifth and final program called Metric/English Converter lets you do just that: convert from convert units of length, weight, volume, either system of measurement.

The five programs that constitute Radio Shack's Personal Finance package for the TRS-80 Pocket Computer sell for $19.95. Besides the Pocket Computer, you'll need a cassette interface and a compatible cassette recorder.

Aviation

by Stan Miastkowski

If you're a private pilot, you know that much of the fun of flying becomes frustration when you have to juggle pads, pencils, tables, and an old-fashioned slide-rule flight calculator to determine such essentials as true winds, course corrections, etc. Well, help has arrived in the form of Radio Shack's AVPACK-I software package for the TRS-80 Pocket Computer. It is designed for private pilots and does a great job of simplifying most of the routine calculations needed for visual flight rules (VFR) flying.

AVPACK has two types of programs—conversion and calculation. The conversion programs convert temperature from Fahrenheit to Celsius and back, convert among statute miles, nautical miles, and kilometers, and (for international pilots) convert among U.S. gallons, imperial gallons, and liters.

conversion program is one that converts hours and minutes into decimal time for many of the calculations).

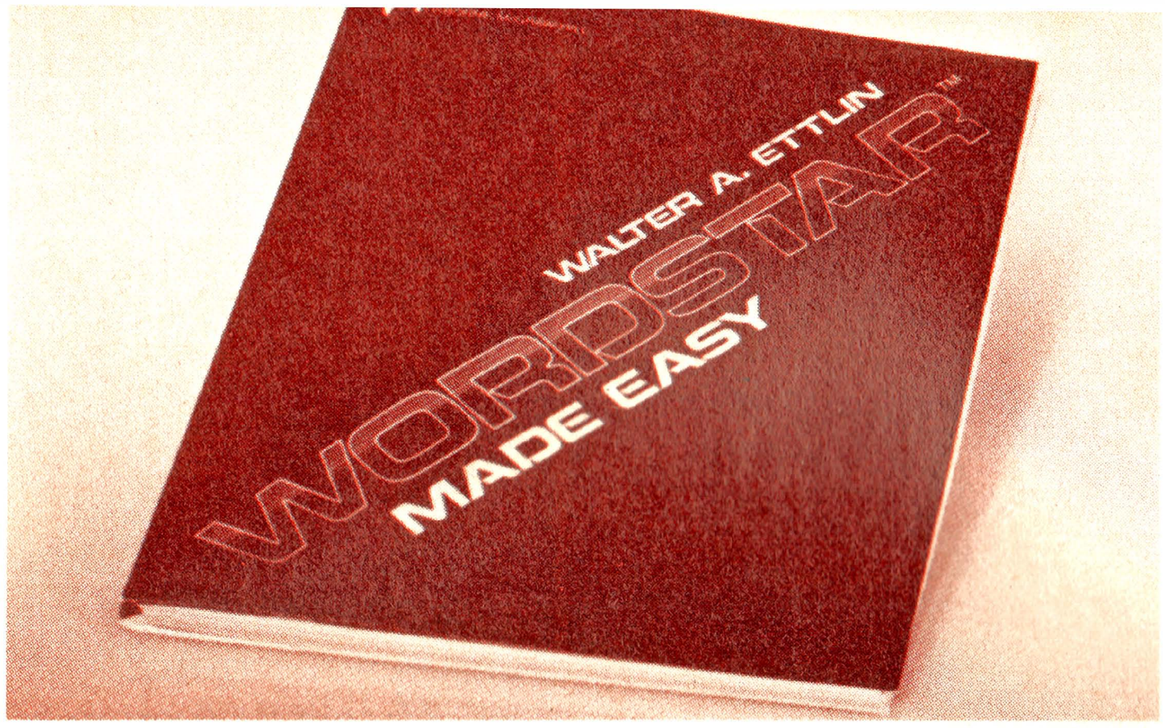
AVPACK *calculates:*

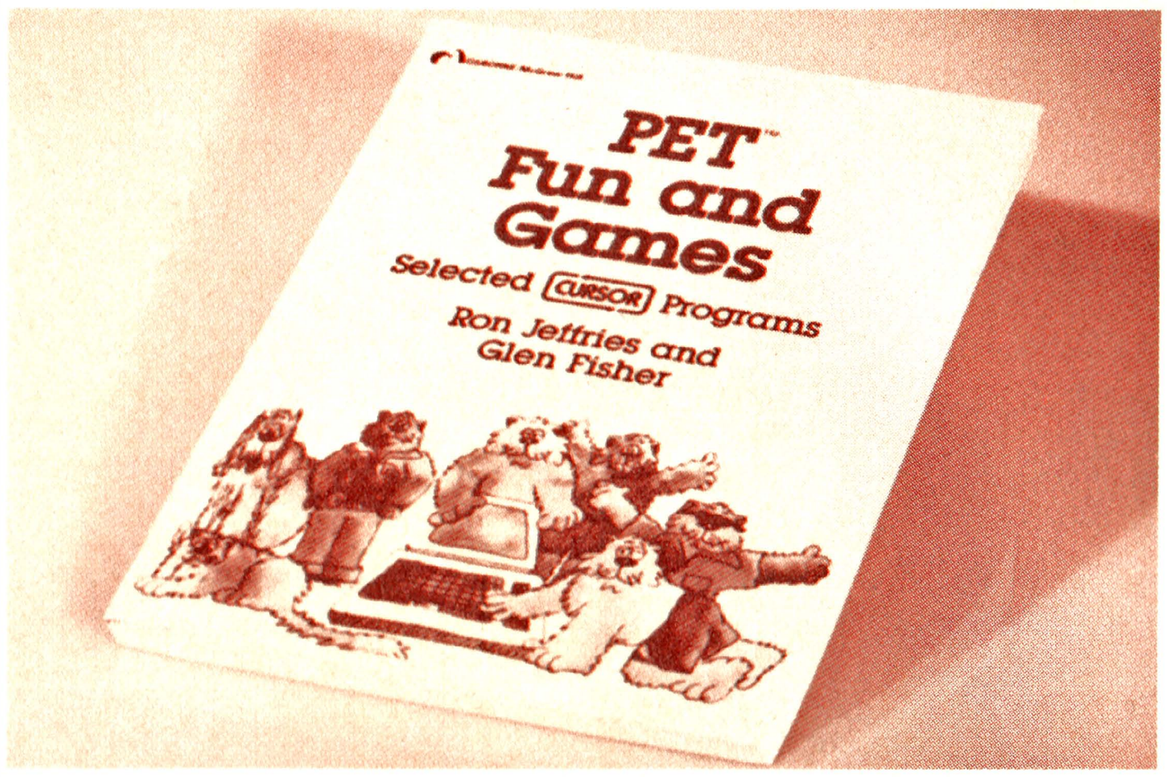
- *true altitude—using pressure altitude, temperature, and altitude of a known ground station*
- *true airspeed—using pressure altitude, indicated airspeed, and temperature*
- *drift and off-course correction angle—using distance off-course, distance flown, and distance left to fly*
- *true heading—relative to true north*
- *enroute wind direction and speed—using true heading, ground speed, true course, and true airspeed*
- *mach number—in the unlikely event a private pilot would ever need it*

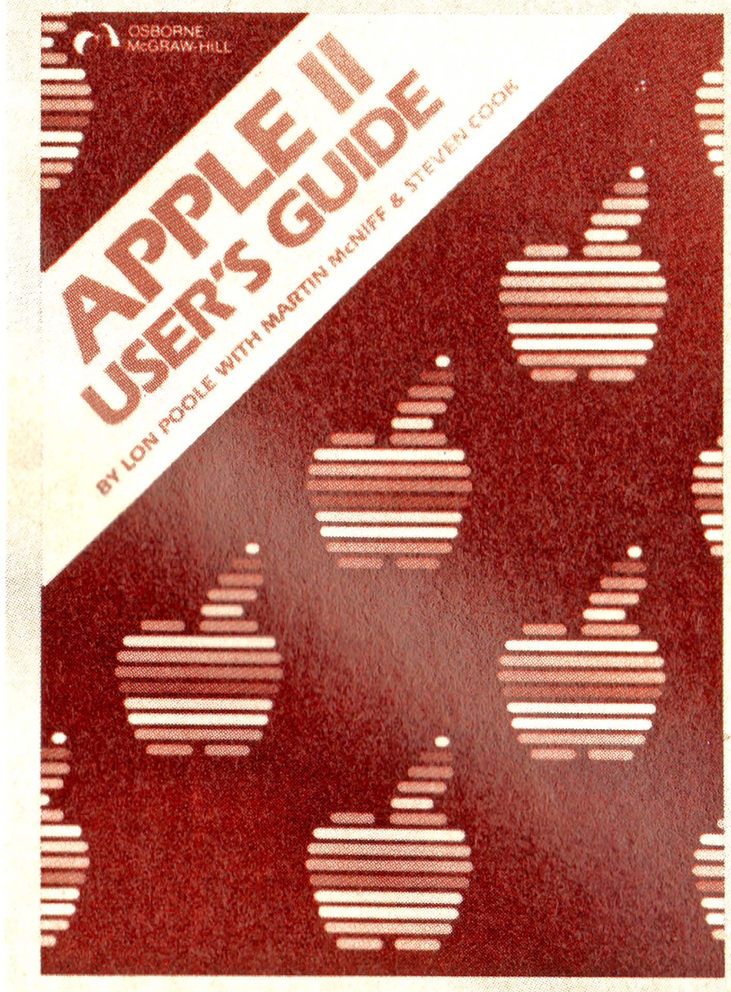
AVPACK sells for $24.95, comes on a single cassette tape, and loads into the TRS-80 Pocket Computer in about two minutes. A program like this is where the TRS-80 nonvolatile memory really comes in handy. Once you load puter, it's there until you erase it with the NEW command. Even turning it off and on doesn't send it to oblivion.

Also included is a plastic keyboard overlay that marks the keys for their new functions under the AVPACK program. The reat thing about the overlay is that after a bit of initial familiarization with how the program works, it's not necessary to keep going back to the instruction book to figure out which keys do what. This small but thoughtful feature needed when it seems you need five hands to keep up with the controls, change frequencies, and talk with air traffic control.

AVPACK doesn't take all the forgotten to enter price it does a great job of reducing the time needed to make routine calculations. The price and features for the whole package beat many aviation- tors that sell for much more. The TRS-80 Pocket Computer with AVPACK loaded into it should be in every pilot's flight bag.







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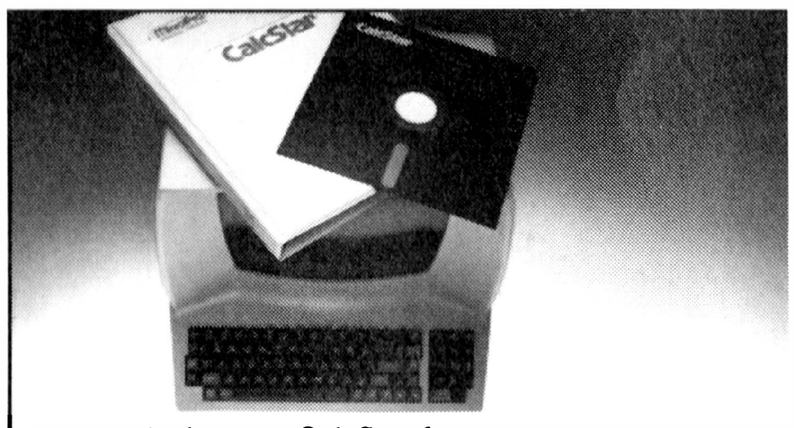

A glance at CalcStar features

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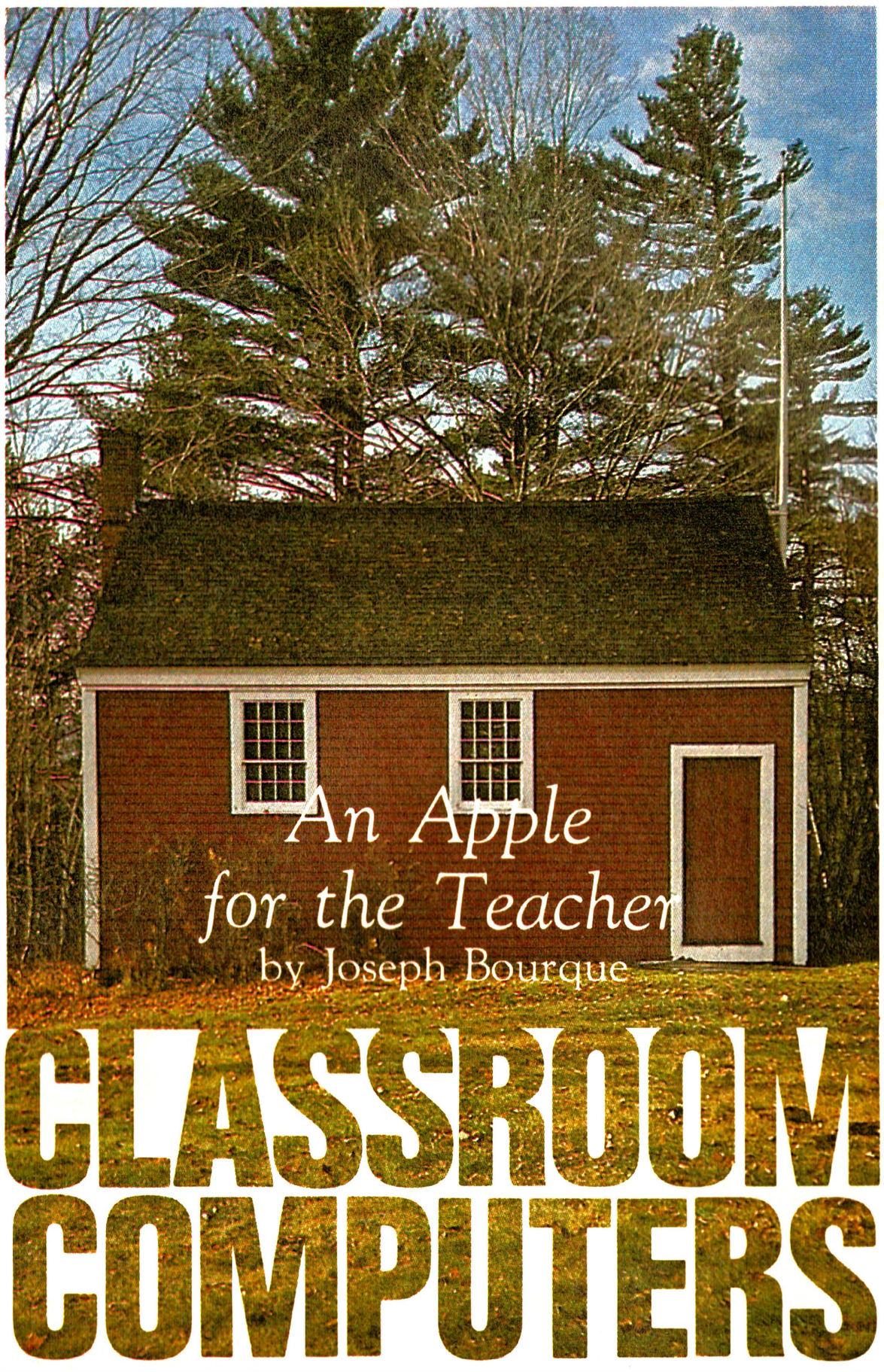


P.S. No. 9 still sounds a lot like it used to when you were a kid—shouts bouncing off the playground, the clatter of books in lockers, the clicking of film running through classroom projectors. But when your kids reminisce, they'll remember something you don't: the electronic whirl and hum of a microcomputer nestled comfortably between last week's biology experiment and a stack of new workbooks.

It happened sometime between your graduation and your kids' first day at school. As data processing broke ground in business, science, and the arts, educators were busy planning the integration of computers and teaching. Forecasting a revolution in education, they generated theories, controversies, news, and frustration as early starts in computer education in the 1950s and 1960s proved false. Timesharing systems (such as Control Data Corporation's Plato) and the larger computers were financially inaccessible to most schools. Theory, it seemed, could not buy hardware. Compounding the problem was a lack of concrete information on implementing computer systems in schools.

In the last decade, however, computer technology has developed at lightning speed. Microcomputers with their lower price tags have made educational computing viable for even the most budget-conscious schools. In 1980, sales of microcomputers for education reached $102 million and annual growth is expected to continue at 31 percent for the next four to five years, according to industry statistics. The off-again, on-again revolution is on again—in earnest.

Joseph Bourque is an associate professor of English at Montana State University and is currently doing research in computer-assisted instruction in university-level writing programs.

Misconceptions Abound

Parents, teachers, and school administrators are attracted to classroom computers for a number of reasons. Most realize that today's schoolchildren will grow up in an increasingly computerized world and that computer literacy tomorrow will be almost as important as reading skills are today. Others find classroom computers exciting simply because they transmit knowledge differently than a film, book, or human teacher does.

But while many realize the computer revolution has arrived, few understand the disorder it's caused. Because of the computer's rapid development, misconceptions abound, information is still not always available, and confusion about the role of computers in education is widespread. The popular image of computers is often a mix of fictional bits and pieces. The computer is the insidious evil that fouls up checking accounts and bills us for endless phone calls to Kalamazoo. It's the manic robot who will someday be nursemaid, teacher, and cordon bleu chef rolled into one, or the superbrain performing fantastic feats of calculation. In education, the computer is often viewed as either the ultrateacher that will save us all or the mindless sergeant that will replace Mrs. Tuttle and her friendly after-school chats.

The truth is, the educational computer can't dominate or save a school system any more than a new plumbing system can. It will educate—or not—depending entirely on how it's used.

The Educating Computer

The role of computers in education is often unclear to those outside the classroom. Sure, you know that Jimmy

Jr. has a computer terminal in the science lab or that the fifth grade teacher has brought her Apple to school, but just what are teachers and, more important, kids, doing with them?

The teaching computer basically plays four different roles: tutorial, drill and practice, simulation, and testing/record keeping.

Tutorial. In the tutorial role, the microcomputer serves as a substitute teacher, guiding students through preprogrammed lessons in a number of subjects. Typically, the student is drawn through a preliminary set of instructions, given information and a background in theory, and then prompted to answer questions. A correct answer to a question moves the program along to the next step; a wrong answer takes the student back over the same information or to a similar problem.

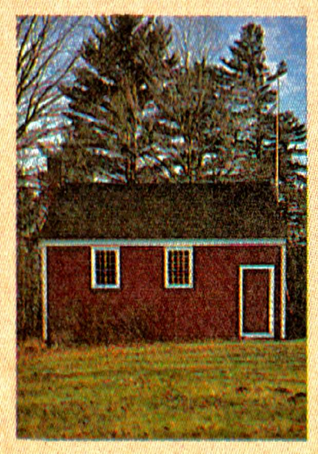
For those who are approaching microcomputers for the first time, the programs can seem relatively sophisticated. For example, there are programs that guide a student through the mechanics of poetry, including connotations, metaphors, images, and metrics. There are programs to help students write their own poems by prompting them to search their imaginations and resources. With the aid of graphics, some surprisingly complicated operations are possible. In chemistry, for instance, the microcomputer can prompt students to type in the names of chemicals necessary to produce a required reaction while the video display screen shows pictures of vessels filling, pouring, and emptying as the chemicals are manipulated. In other subjects, computer graphics can be used for charts, maps, and graphs.

In addition to preprogrammed coursework, teachers can use "author languages" to experiment with instructional ideas. Author languages are simple instructions that provide relatively complex ways of manipulating information without the need for a background in computer programming.

Drill and Practice. The drill and practice role of a computer sometimes overlaps the tutorial function, but the emphasis here is on repetitive practice rather than the acquisition of new knowledge. Many lower-level math skills and English grammar programs fall in this category, often providing the kind of individualized attention that most teachers wish they had time to offer. For example, when an English teacher spots a recurring error in a student's writing, the student can be referred to an appropriate program that will lead him or her through repetitive exercises in comma splices or dangling modifiers.

Simulation. Possibly the most exciting innovation in teaching is computer simulation. In this role the microcomputer can bring a whole new dimension to classroom instruction by setting up "real life" situations that require students to apply theory to practical problems. For instance, one program sets up a world model based on population, food supply, industrial output, and resource depletion. Students are asked to control the model and make it productive by typing in what seem to them to be appropriate values for six variables such as birth rate, death rate, industrial output, growth rate, and food production. The microcomputer then performs calculations with their figures and projects the fate of the model in 10, 20, 30, 40, or 50 years. The students can try to change the fate of the model by changing one or more of the variables. Such simulation programs exist for a wide variety of situations—herd management, erosion, war, public policy, science, and more.

Testing and Record Keeping. Computers can lighten the teaching workload by storing test results, grading, averaging, and ranking students. They can manipulate the information to provide the teacher or student with a "hard" (printed) copy of a student's individual or class performance.



A computer system can't dominate or save a school system any more than a new plumbing system can.

Computer Discovery

There's one more key role the computer plays in education—teaching students about itself. Computer literacy is becoming a critical issue for children today simply because of the influx of computers in the workplace and the home. While many children may not choose a field in which data processing is a required skill, before long, experts say, at least some familiarity with computers will be needed to cope with the number of computers that will appear in our daily lives.

Although interacting with a computer teaches children about the technology as well as the subject area under consideration, there are also computer programs that guide students through computer history, usage, and programming. Learning computer languages has become somewhat like learning French or Spanish in schools: now it's Pascal and BASIC.

Plugging In

It's still too early to predict the effect computers will have on education, but their presence in any school system creates a particular set of issues and questions—a reality that school administrators, teachers, and parents are coping with now.

Concerning software (computer programs), for example, there are a number of questions. Is the teaching method sound? Are programs designed for certain needs or will the teacher have to write his or her own? Who teaches the teacher to use the program? How often is the software updated? The list goes on.

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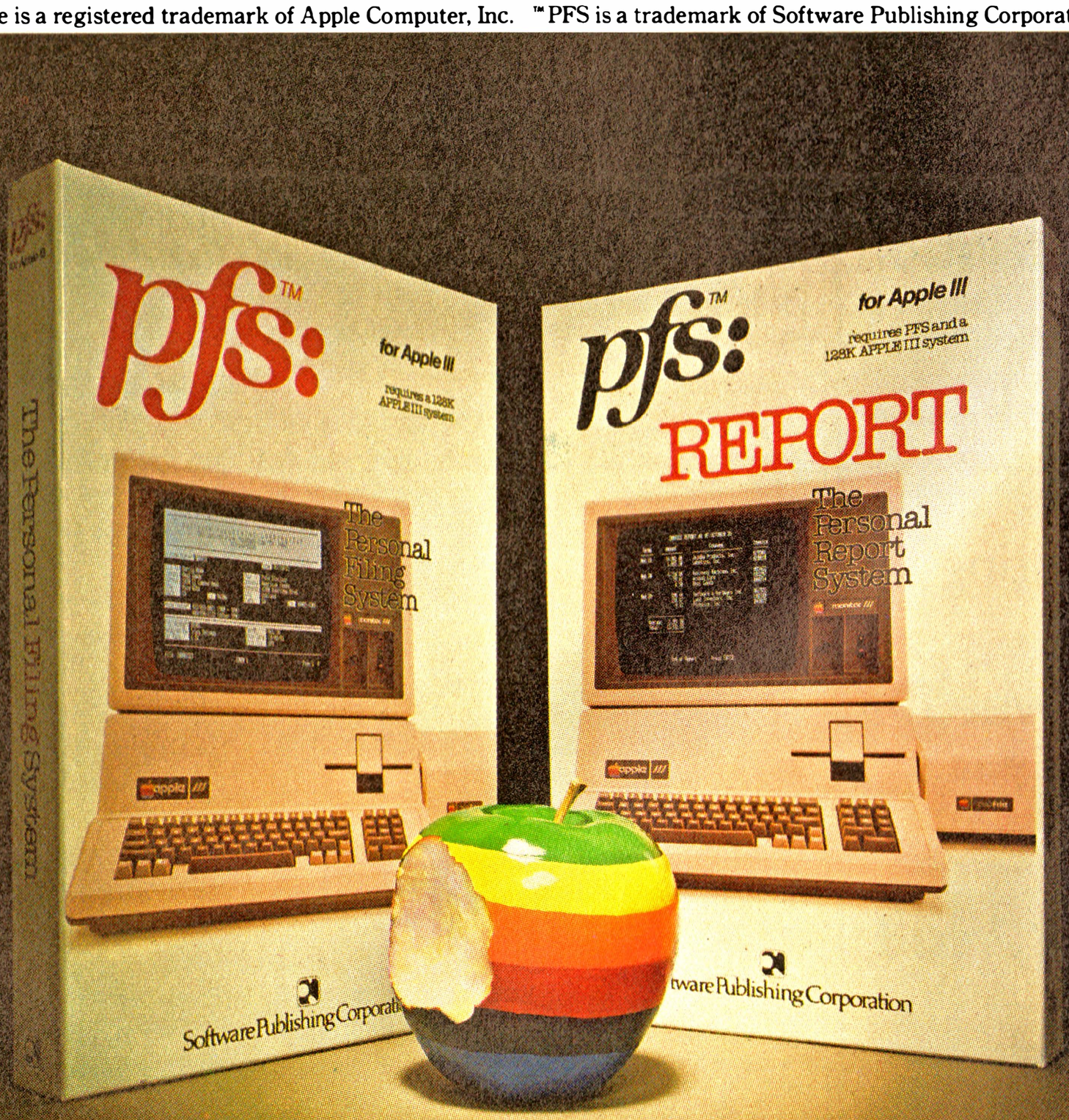

One important issue that schools face when purchasing a computer system is where to put it. Most schools buy computers in groups, so the temptation is to place single units in each classroom where they'll get the most use. But educators have found that grouping computers in one room or in a computer center encourages the natural tendency of students to interact and help one another. Some experts advise against putting the computer in the math department to discourage the image of the computer as a math tool exclusively. Computer-systems experts also advise schools to keep computers away from high concentrations of chalk dust, static electricity, or other damaging environments.

As with any new technology, countless questions must be answered and decisions made when integrating it into a traditional field. The effects of classroom computers on students must be monitored and changes made when necessary. But for all the disorder, for all the upheaval and controversy generated, the teaching computer is here to stay. Bringing an Apple to the teacher may never be the same. □

Helpful Resources

Here is a brief list of resources for further information about educational use of computers:

A Few Recent Books:

Moursund, David. *School Administrator's Introduction to Instructional Use of Computers.*

———. *Teachers' Guide to Computers in the Elementary School.*

———. *An Introduction to Computers and Computing.*

All published by International Council for Computers in Education (ICCE), Department of Computer and Information Science, University of Oregon, Eugene, OR 97403.

Papert, Seymour. *Mindstorms: Children, Computers, and Powerful Ideas.*

Poirot, James and Kathleen Swigger. *Computer Literacy.* Sterling Swift, 1981.

Taylor, Robert. *The Computer in the Schools: Tutor, Tool, Tutee.* New York: Teachers College Press, 1980.

Nonprofit Organizations:

These nonprofit organizations provide information, conduct workshops, publish newsletters and articles, and in some cases develop or distribute educational software.

Computertown, USA!, POB E, Menlo Park, CA 94025.

Conduit, POB 388, Iowa City, IA 52244.

CUE (Computer Using Educators), c/o Independence High School, San Jose, CA 95133.

HumRRO (Human Resources Research Organization), 300 North Washington St., Alexandria, VA 22314.

MECC (Minnesota Educational Computing Consortium), 2520 Broadway Dr., St. Paul, MN 55113.

Microsift, Northwest Regional Educational Laboratory, 300 S.W. Sixth Ave., Portland, OR 97204.

TERC (Technical Education Research Centers), 8 Eliot St., Cambridge, MA 02138.

Professional Associations:

These organizations hold regional and national meetings, and publish conference proceedings and academic journals.

ACM (Association for Computing Machinery), 1133 Avenue of the Americas, New York, NY 10036. This organization has several subgroups related to educational computing:

SIGCUE (Special Interest Group on Computers in Education)

SIGCSE (Special Interest Group on Computer Science Education)

ESSS (Elementary and Secondary Schools Subcommittee, pronounced "ES-cubed")

ADCIS (Association for the Development of Computer-Based Instructional Systems), c/o

Unive

AEDS (Association for Educational Data Systems), 1201 16th Street, N.W., Washington, D.C. 20036.

NECC (National Educational Computing Conference), c/o Gerald L. Engel, Computer Science Department, Christopher Newport College, 50 Shoe Lane, Newport News, VA 23606.

NCTM (National Council of Teachers of Mathematics), 1906 Association Dr., Reston, VA 22091.

Periodicals for Computer Education:

Classroom Computer News, 51 Spring St., Watertown, MA 02172.

Educational Technology, 140 Sylvan Ave., Englewood Cliffs, NJ 07632.

Electronic Learning, 902 Sylvan Ave., Englewood Cliffs, NJ 07632.

The Computing Teacher, ICCE, Department of Computer and Information Sciences, University of Oregon, Eugene, OR 97403.

T.H.E. (Technological Horizons in Education) Journal, POB 992, Acton, MA 01720.

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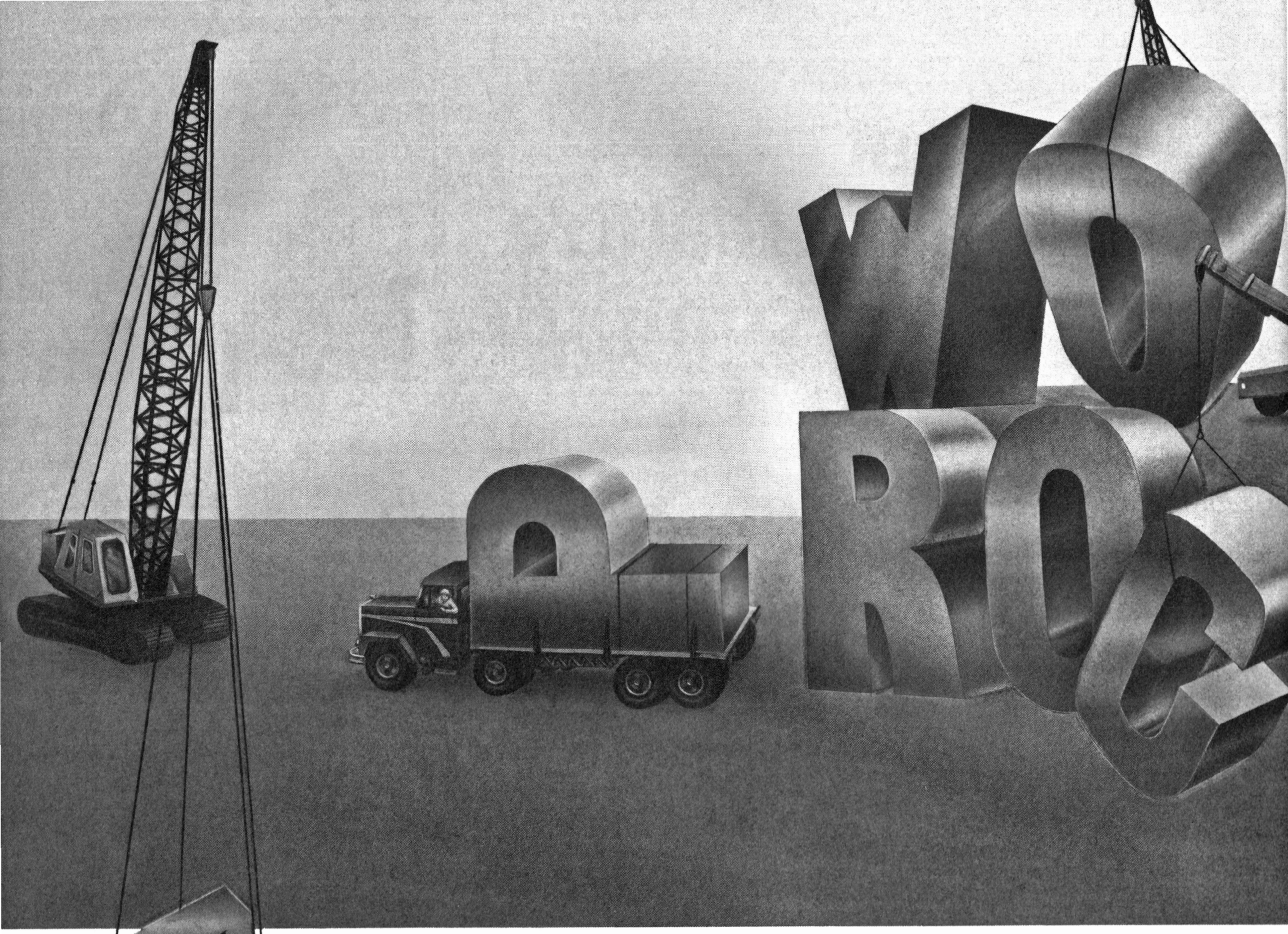

word-processing program is only as good as the hardware that runs it. The successful interconnection of keyboard, video display, printer, and storage device plays a major role in determining the productivity of your word-processing system. In this article, I'll suggest what you should look for in an ideal word-processing computer system.

The Terminal

The keyboard and video screen are the most important parts of your word-processing system. Together they are known as the *terminal*, at which you'll spend most of your time. You must feel totally comfortable with both.

The screen should display characters that are crisp, sharp, and clear.

by Peter McWilliams

A character is formed on the video screen by little dots, and the more dots there are, the sharper the character. The dot pattern is usually called the *dot matrix*. Specifications should list how many dots running horizontally and how many running vertically make up a letter; 6 by 8, 7 by 10, or 14 by 10 are common, with higher numbers indicating better resolution. Then there are the questions of how many characters fit on a line and how many lines are displayed on the screen. Lower-priced screens offer 64 characters and 16 lines or fewer. Better terminals will display 80 characters and 24 lines. Twenty-four lines equal about half a typewritten page, and that's plenty of room to see what has gone before. Also, if you need to review, scrolling to another part of the text is fast and easy. Video screens that display full pages of text (55 lines or so) can be hindrances. Studies have shown that the operator spends a great deal of time actually touching the screen to hold a place because too much information is displayed at once.

Green-phosphor screens are supposed to be easier on the eyes. I really don't know. My suggestion is to try both a black-and-white and a green-phosphor video screen to see which you prefer. If you do decide to get a green screen, make sure the actual *phosphor* is green; don't get a black-and-white screen with a green plastic covering. Amber-phosphor screens might also merit a trial run.

The Keyboard

The keyboard should be a standard typewriter keyboard with large letters and slightly curved keys. If you work with numbers frequently, a *numeric*

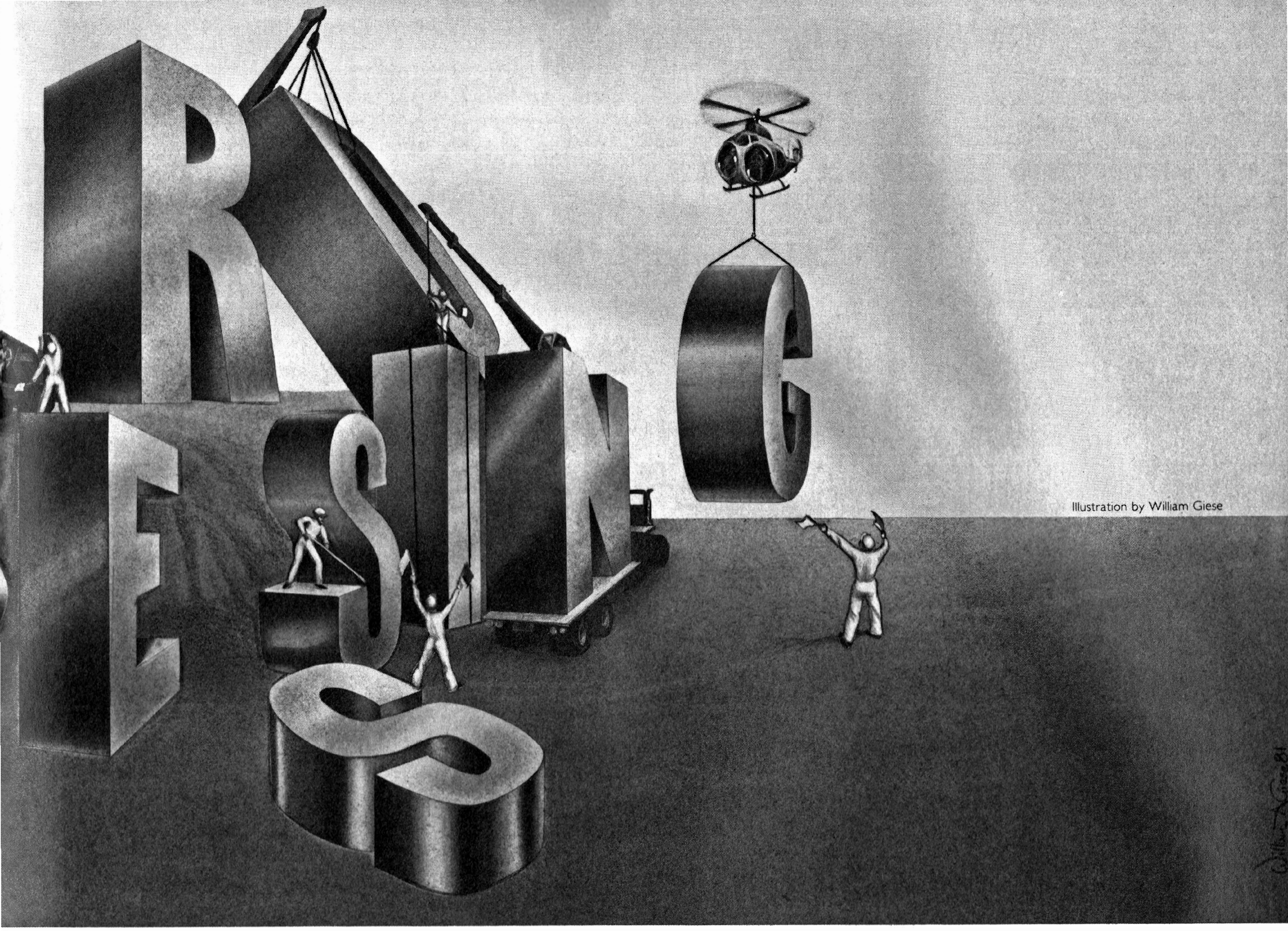

Illustration by William Giese

keyboard (keys for the numbers 0 through 9 placed to the right of the regular keyboard) is a must.

As you hit a letter, you shouldn't hear a plastic "ping" echoing through the keyboard. A keyboard that sounds cheap requires more effort to use. Most of all, *you* must enjoy typing on it. A great many keyboards are out there. Try them all until you find the one that feels best to you.

From personal experience, I recommend a detachable keyboard instead of one fixed to the video screen. With a detachable unit, I can lean back in my chair, put the keyboard in my lap, and relax. When editing, I move the keyboard closer to the screen so I can see the text more clearly.

The Printer

Our next consideration is the printer. There are basically two kinds: *dot-matrix* and *letter-quality*. Dot-matrix printers cost less and print faster, yet the quality of the printed text, while readable, leaves much to be desired. Letter-quality printers cost more and print more slowly, but the quality of their finished pages rivals that of the best electric typewriters. Which is better for word processing? Clearly, letter quality is preferable. Correspondence, manuscripts, term papers, almost anything but in-house financial statements looks unbearably chintzy when printed on a dot-matrix printer.

Which letter-quality printer is best? Three kinds are available: *converted typewriters* (such as the IBM Selectric or Olivetti Praxis), *daisy-wheel*, and *thimble*. Although reasonably priced, the typewriters print slowly, about 15 characters per second (cps), and can't do all the things daisy-wheel or thimble printers can. They may also require more servicing than daisy-wheel or thimble printers but when properly adjusted produce excellent printing.

Daisy-wheel printers are so named because the printing element is a metal or plastic circle with "petals." Similarly, thimble printers use an element that resembles a thimble. Metal daisy-wheel printers yield better results than do their plastic cousins, but plastic wheels print faster. Thimble printers combine maximum speed (around 55 characters per second or about 450 words per minute) with maximum print quality. Thimble printers are slightly more expensive than daisy wheels.

You can save quite a bit of money by buying a daisy-wheel or thimble printer that prints 15 to 25 cps rather than 55 cps. Everything will take twice as long to print, but you'll save almost $1000.

Disk Drives

The next items to be considered are disk drives. Are disk drives necessary for word processing? No. Are they

necessary for any *serious* word processing? Yes. What's serious? Any text longer than a three-page letter is serious. Major block moves or file insertions are serious. The desire for moderate speed and accuracy is serious. In other words, if you want your word processor to write something more significant than an occasional letter, you'll need a disk drive.

Not only do disk drives allow for maximum flexibility with the material you create, they also allow your computer to take advantage of the finest software. The most powerful programs are generally available only on disks and often require at least one disk drive. How many disk drives do you need? You could get by with one, but you'd be a lot happier with two.

With two drives, you'll have more *online* storage. This means that files (your documents) can be longer; you can store dozens of standard paragraphs for insertion into letters, contracts, and manuscripts. You can also have more programs online, enabling you to work on one file with several programs (text editing followed by spelling checking followed by word counting, for example).

Second and perhaps more important, with two disk drives, copying files and disks for your personal backup library is a breeze. Copying is an essential part of computerized word processing, as backup copies of disks are vitally important. It's possible to store hundreds of pages of text on one disk. If anything should happen to that precious disk—from spilling coffee on it to feeding it to a disk-hungry computer—all your work is lost. Copying whole disks with two disk drives takes minutes. With only one disk drive, it takes much longer or, in some cases, is impossible.

Now that we've equipped the ideal word-processing computer with two disk drives, what *size* is preferable, 8-inch or 5¼-inch? While 8-inch disks hold more information, their size makes them considerably more expensive. As a result, 5¼-inch disks prevail in personal computing, while 8-inch disks are common in small-business computer applications.

If cost is of little concern, your choice will depend largely on how much storage you'll need at any one time. The amount of information stored on a disk is measured in *kilobytes*, or *K*s. Each K is equal to 1024 letters, numbers, or spaces. A typewritten, double-spaced 8½- by 11-inch page (with generous margins) contains approximately 2K

If word processing will be a primary use for your computer, buy a system ideally suited for that application.

bytes of information. This constitutes a good rule of thumb when deciding how much disk storage you'll need.

What's the longest continuous document you'll regularly edit on a word processor? Find out how many Ks that would be, multiply by three, and that will give you the approximate disk size needed for *each* of your two disk drives. For example, if your longest continuous document equaled about 25 double-spaced, typewritten pages, that would be around 50K bytes (2K per page): 50K tripled is 150K. Hence you would need two disk drives, each with a storage capacity of at least 150K bytes.

Why multiply by three? Many good word-processing programs automatically keep a "safe copy" on disk of each file. You'll always have a copy of the original to fall back on. This safety measure is rarely needed, but when it is, it's a blessing. It does, however, mean that a 50K-byte file, when backed up, will take 100K bytes of disk space.

Okay, that's double. Why triple? For safety, an error margin, a buffer zone, that sort of thing. Many word-processing programs add formatting codes that, although invisible on the video screen, add a K here and there to disk storage space. There's nothing worse than having an absolute masterpiece in the memory of the computer and, right in the middle of transferring it to a disk, the video screen signals DISK FULL. Well, just put in a new disk, you say. Alas, it's not always that easy. Solutions can usually be found, but they differ from program to program.

A *continuous* document is one in which you frequently move blocks of information, yet remain within the same file. A continuous document file need not be the length of an entire book. The length of an average chapter or chapter section may be all the file space needed. Each chapter or section can be stored on a separate disk.

Before we leave disks, a word about hard disks is in order. Hard disks hold huge amounts of information and are very expensive. For most word-processing applications, you won't need a hard disk; putting your information on a series of floppy disks and changing disks when the information is needed will usually suffice. Hard disks would be needed, for example, in legal departments, where there are thousands of standard paragraphs that must be accessed continuously when writing contracts. Hard disks would also be needed to maintain a large mailing list. Such disks are used more often for data processing than for word processing.

What, then, would be the specifications of a personal computer used almost exclusively for word processing—a word processor that would get the job done without going overboard? The following describes my ideal word-processing system:

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Peter McWilliams is a freelance writer based in Los Angeles.

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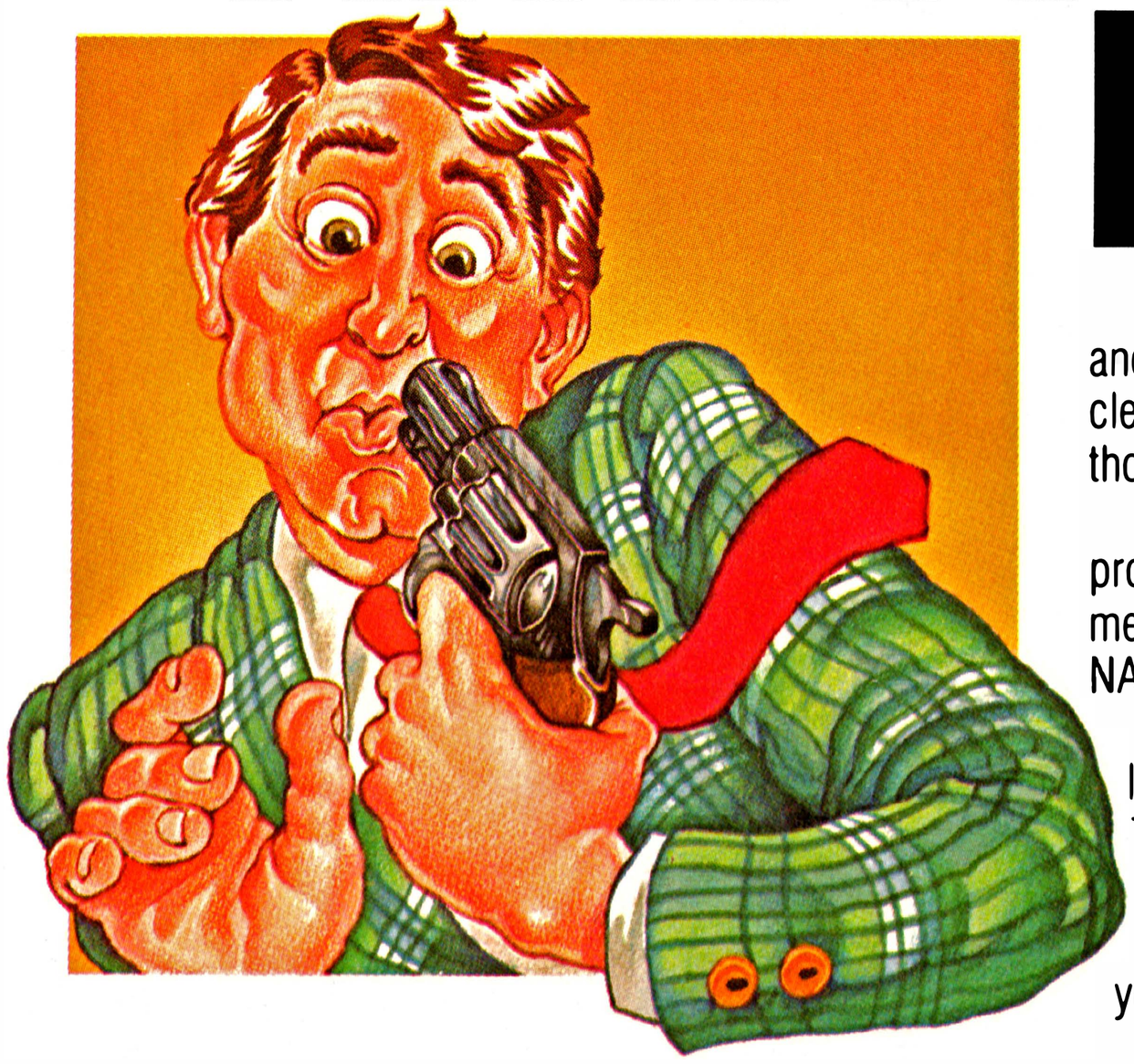

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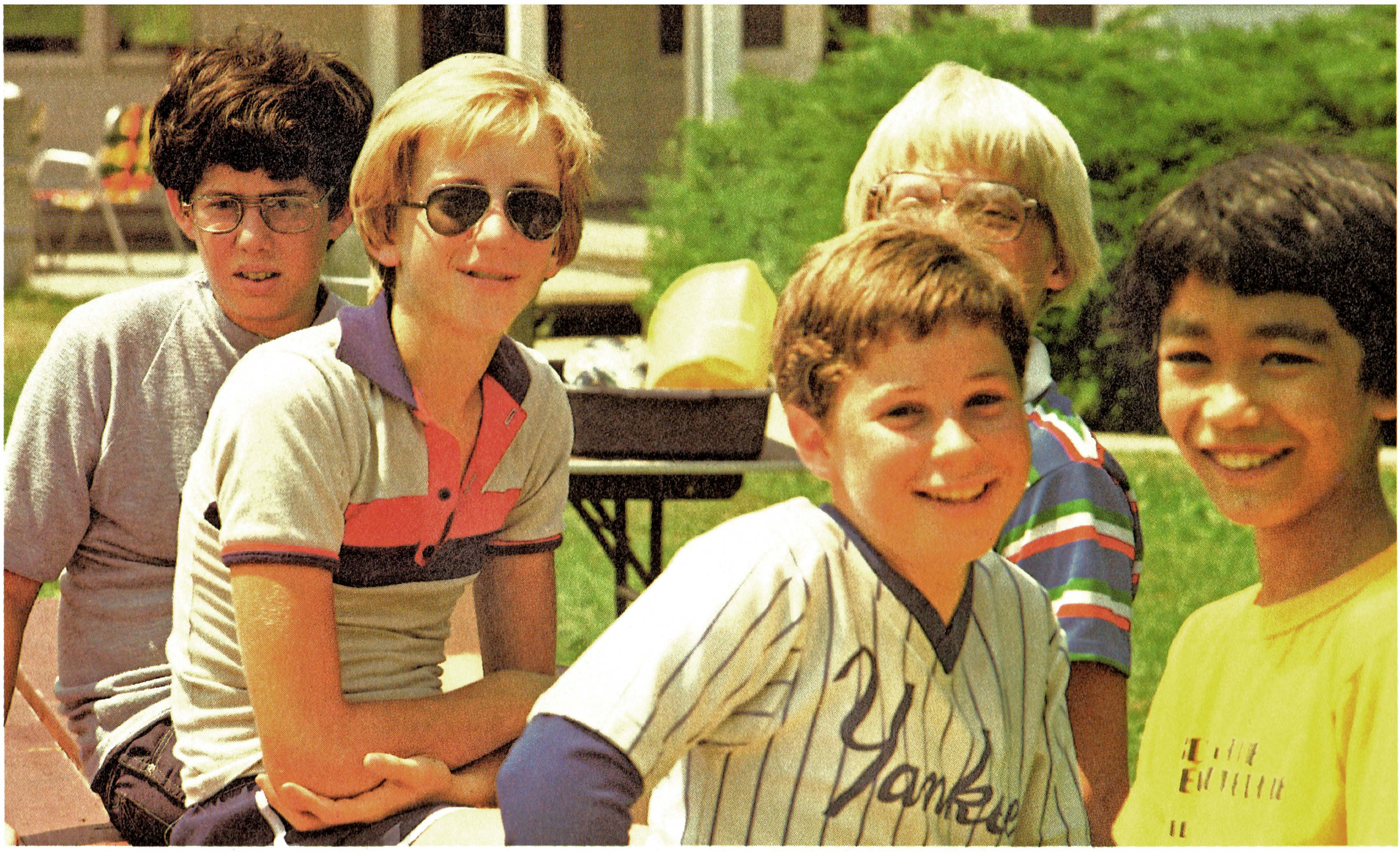

Camping with Computers

by Heidi Copeland

While education plays a constant catch-up game with the lightning-paced computer industry, there's one geared-to-children business that's trying to narrow the gap: computer camp. In two camps in Connecticut and two in California, vacationing campers cavort to the rhythm of high-tech rec. Exit lazy days under a midsummer sun; enter a two-week stint basking in the blue glow of computer terminals. And, by the way, welcome to the *real* computer-age generation.

Computer camps have most of the same draws as regular old-fashioned summer camps, from swimming and volleyball to short-sheeting and bullfrog catchin'. But the 10- to 18-year-old campers also sit at the keyboard six hours a day, boning up on BASIC and advanced languages, electronics and graphics.

Sessions usually last one or two weeks and costs range from $295 a week to $795 for two weeks. Even at these high prices, boys and girls descend on the camps from such far-flung places as France, Great Britain, Venezuela, Mexico, Japan, Kuwait, Denmark, and Canada. Most stay one or two weeks although a few whiz-kids spend the summer.

> Vacationing kids are cavorting to the tune of high-tech rec.

The East Coast Version

The first computer camp was started by Michael Zabinski a mere five years ago. Located in Moodus, Connecticut, National Computer Camp is smack in the middle of the state's lush resort country. In fact, the 150 boys and girls who attended last summer's sessions stayed at the Klar Crest Resort, a once trendy hangout for New York's upper-crust.

Many arrive with programming skills and a specific project already in mind. One girl, for example, planned in advance to write a program that would organize her father's investments and review and update his stocks.

Other kids get off the bus with no computer experience and are nursed on a diet of games and fun programs for the first few days. As game skills develop, campers become curious about how the games work and want to compose their own. At that point, a staff member explains what "writing" a game means. "If you want to invent a game, you must know something about pro-

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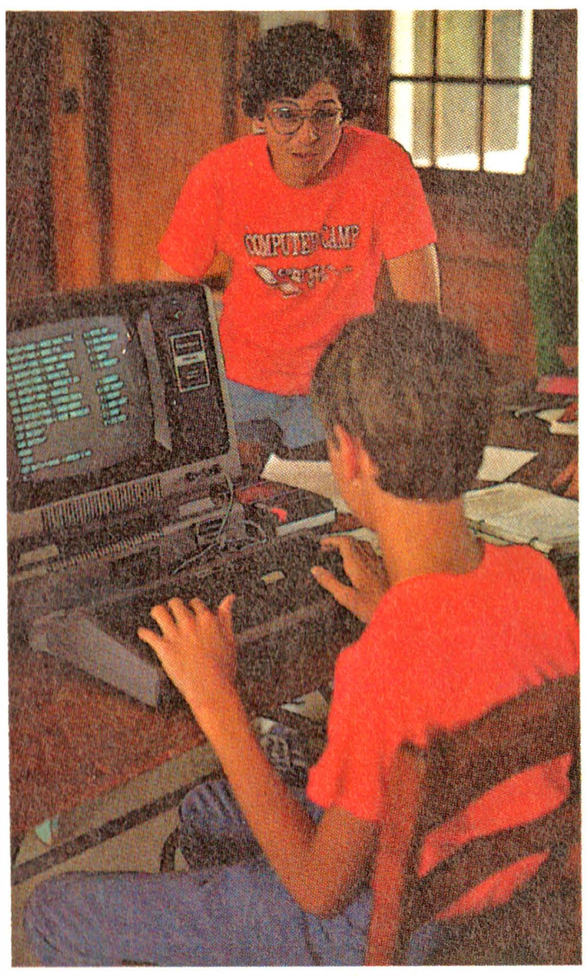


gramming. If you want to learn programming, you must know a computer language," Zabinski says. From that point on, the children's sessions are filled with projects designed to develop programming skills. By the time they leave, most kids have at least one original game under their belts.

The computer camp fills a void created by inadequate school curricula, Zabinski says. "Kids are fascinated by computers and there's no place for many of them to learn." But his computer clinic is recreational as well as educational. "We are not a summer school," he emphasizes.

Many of the programs the kids design are nonacademic—they consider them plain old fun. One boy wired his terminal for sound. When someone clapped, the message "I read you" flashed on the screen. Two other self-proclaimed junk-food junkies wrote a program for a fast-food franchise. Customers punched in their food order—a cheeseburger-hold-the-pickles, french fries, and a shake—and the computer totaled the meal bill and added the tax.

All in a Day's Play

A typical day at the National Computer Camp begins, sans reveille, at the crack of dawn. Campers pour into two large rec rooms and for several hours plug feverishly at their projects on some 50 Wang, Apple, and TRS-80 terminals before breaking for a traditional hot-dogs and hamburgers lunch. Long before the computer chambers reopen, programmers hover about the door, eager to return to their terminals. They joke about "Doc" Zabinski's 32K memory (he remembers everyone's name) and exchange stories about last night's cottage raid, the refrigerator sabotage, and the other camp escapades. They also kid one youngster who, having engaged in a 3 a.m. shuffleboard contest, fell into a deep sleep the following morning at his terminal, glasses askew.

Allowed back into the air-conditioned rec halls, the campers dash to the terminals. Twenty counselors (all elementary or secondary school teachers) guide their charges through an afternoon's electronic odyssey. Some take their disciples out onto the veranda for an impromptu discussion on programming styles, while others teach a Canadian contingent how to design a maple leaf with a computer. By day's end, the kids haven't had enough. Evenings are filled with video-game tournaments or free computer time. And the campers still complain when they are ousted from the recreation room by 9 p.m. One 10-year-old laments, "The only reason they kick us out is because the counselors want to play with the computers."

Zabinski attributes the children's zeal to the challenge of the computer. "They approach it with uncluttered minds and a willingness to figure out how it works," he says.

Even so, some kids have very adult reasons for attending computer camp. Take Michael Teitelbaum of Westchester, New York. At 16, he was the oldest camper at last summer's two-week session and he signed up for the

camp because "it would look good on my transcripts." By the time he graduates from college, he adds, computer scientists will be making $75,000. "I plan to be a dentist just like my father," he says with a smile, but don't think this lanky teenager hasn't considered computers as an interim occupation.

Salaries might not seem like traditional adolescent conversation, but most campers do have ideas about what they want to be when they grow up. One 10-year-old talks about his future with the aplomb of a true futurist. "I've narrowed my choices to nuclear physics and computer science," he says.

The West Coast Version

Across the country and a bit north of Santa Barbara, California, Denison Bollay's Computer Camp at Zaca Lake is enjoying its own success. Camp director Garry White accounts for it easily. "First, we are not pioneers—we are catching up. The science of computers, and hardware in particular, is very far ahead, while the people are very far behind. What we want to do is bring people up to the level of the hardware. Second, the traditional establishment is too slow in its response to scientific development and academics are way behind in terms of computers, mainly because of a personnel shortage. Third, and above all, kids simply love computers."

An air-conditioned trailer houses the two classrooms, and a mound of shoes outside the door—a dust-minimizing rule—signals that sessions are in progress. Inside, kids busily hammer on 30 "kid-proof" Atari 400s, on loan from the manufacturer (who's well aware that children influence purchases). "The boards are designed so they don't short out if a soft drink is spilled on them," says one camp counselor. On hand, too, are five Commodore CBMs, one Commodore PET, four TI 99/4s, and two Apple IIs. There's also a talking-drawing turtle tabletop robot to program. And for afterhours play, there are always one or two TRS-80s, as well as some homemade units, floating about in the cabin dorms.

"Kids learn fast," says instructor Arne Jamtgaard, adding that the students are too intrigued by the sense of play to be intimidated by the machines. "I come back after class sometimes and they're drawing pictures all over the place. They're exhilarated when they discover a way to complete an assignment. They're beginning to think like programmers."

Still, the run-of-the-mill attendee is not particularly talented in math, according to staff member Brian Colvin. "In fact, 50 percent have never seen a computer until they stay here." A few kids are forced to attend, but usually return home with computer fever, Colvin adds.

Parisian Eduardo Servan-Schreiber heard about Computer Camp from the bestseller *The World Challenge*, written by his father, Jean-Jacques Servan-Schreiber. The 12-year-old had already learned BASIC at school and wanted to study Pascal. "I told my father I want to go to that computer camp," Eduardo says. And he did—for two sessions.

There are girls at the West Coast camp, too, but number-wise only about nine for every 80 boys. (At National Computer Camp, the average is one girl for every five boys.) Amy Vandersteel, 14, has a brother who works for a computer firm and was initiated to the keyboard at age 11. Now she wants to mix a career of marine biology and computer science. "Computers are going to be the future for everyone. And they'll keep things together a lot better than humans. Kids see how computers do things and they get along instantly. But it's harder for adults. They went to school doing everything by hand," she says.

At both Computer Camp and National Computer Camp, the return rate is high. And at NCC there are eight computer levels, leaving plenty of room for most of the students to advance.

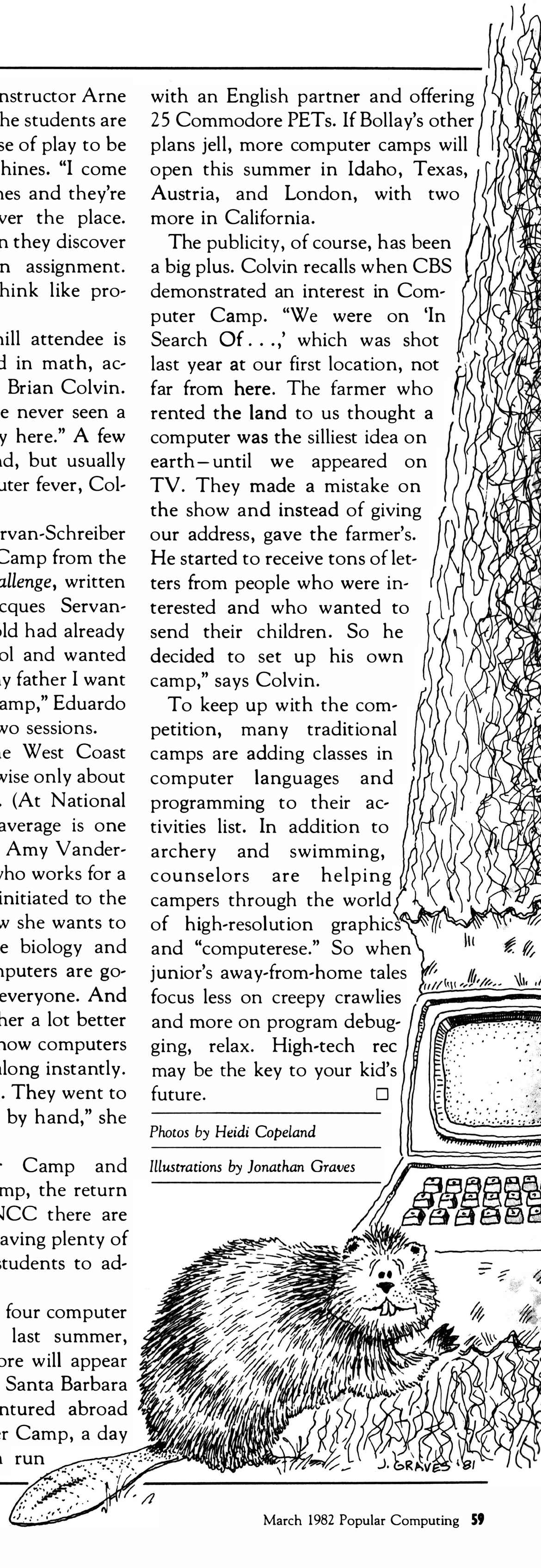
While there were only four computer camps in the country last summer, most experts predict more will appear this year. Buoyed by his Santa Barbara success, Bollay has ventured abroad with a second Computer Camp, a day facility outside London run with an English partner and offering 25 Commodore PETs. If Bollay's other plans jell, more computer camps will open this summer in Idaho, Texas, Austria, and London, with two more in California.

The publicity, of course, has been a big plus. Colvin recalls when CBS demonstrated an interest in Computer Camp. "We were on 'In Search Of . . .,' which was shot last year at our first location, not far from here. The farmer who rented the land to us thought a computer was the silliest idea on earth—until we appeared on TV. They made a mistake on the show and instead of giving our address, gave the farmer's. He started to receive tons of letters from people who were interested and who wanted to send their children. So he decided to set up his own camp," says Colvin.

To keep up with the competition, many traditional camps are adding classes in computer languages and programming to their activities list. In addition to archery and swimming, counselors are helping campers through the world of high-resolution graphics and "computerese." So when junior's away-from-home tales focus less on creepy crawlies and more on program debugging, relax. High-tech rec may be the key to your kid's future. □

Photos by Heidi Copeland

Illustrations by Jonathan Graves



Disk Operating Systems

DOS. It rhymes with "boss" and it's what makes your disk system tick.

by William Barden, Jr.

CP/M. Apple DOS. NEWDOS. LDOS. TRSDOS. Confused by disk operating systems? Wondering whether or not to pay extra for a computer with disk drives? Perhaps you have a small computer with cassette-tape storage and would like to upgrade to floppy-disk drives. Will disk drives really give you that much power, or are they just an expensive option?

The capabilities of a small-computer disk system are, to a large extent, determined by its disk operating system (DOS). In this month's column, I'll discuss some of the features of operating systems in general so you can determine whether or not they're worth your computer dollars.

Speaking of Disks . . .

Operating systems for small computers are almost always disk operating systems. Because they're intimately related to disk storage, you'll need to understand the characteristics and jargon of disk drives and media.

The terms *disk* and *diskette* are generally interchangeable. A disk resembles a flexible phonograph record and comes in 5¼-inch and 8-inch diameters. Disk drives are characterized by the size of the disk they "play." Like records, disks spin inside the drive. (You don't see or handle the actual disk because it's encased in a protective envelope.)

To explain how information is stored on disks, we must discard the phonograph analogy and look to magnetic tape recordings instead. Disks are coated with a thin layer of ferromagnetic material. An electromagnetic head inside the disk drive stores and retrieves information in the form of magnetic patterns (this process is similar to that used in audio tape recorders).

Data is stored on disks in concentric circles called *tracks*, with each track further divided into *sectors*. A sector is defined as the amount of information that can be read or written in a single operation. Sector length ranges from 128 to 512 bytes of data on most small-computer disk systems. Figures 1 and 2 illustrate the typical floppy disk.

What good is all this information to you? Well, it should help you wade through advertising claims and sales pitches by giving you an idea of the total data capacity of a single disk in the system you're considering. Here's the formula—no higher math needed, believe it or not:

Total Data Capacity
= number of tracks
× sectors per track
× bytes per sector

Bear in mind that this is a "raw" figure; actual data capacity may be considerably less due to overhead for the computer's own use. Be sure to find out how much the computer will use, then subtract that amount from the figure you came up with when you applied the formula.

A typical 5¼-inch disk holds 90,000 to 180,000 bytes per side, while a

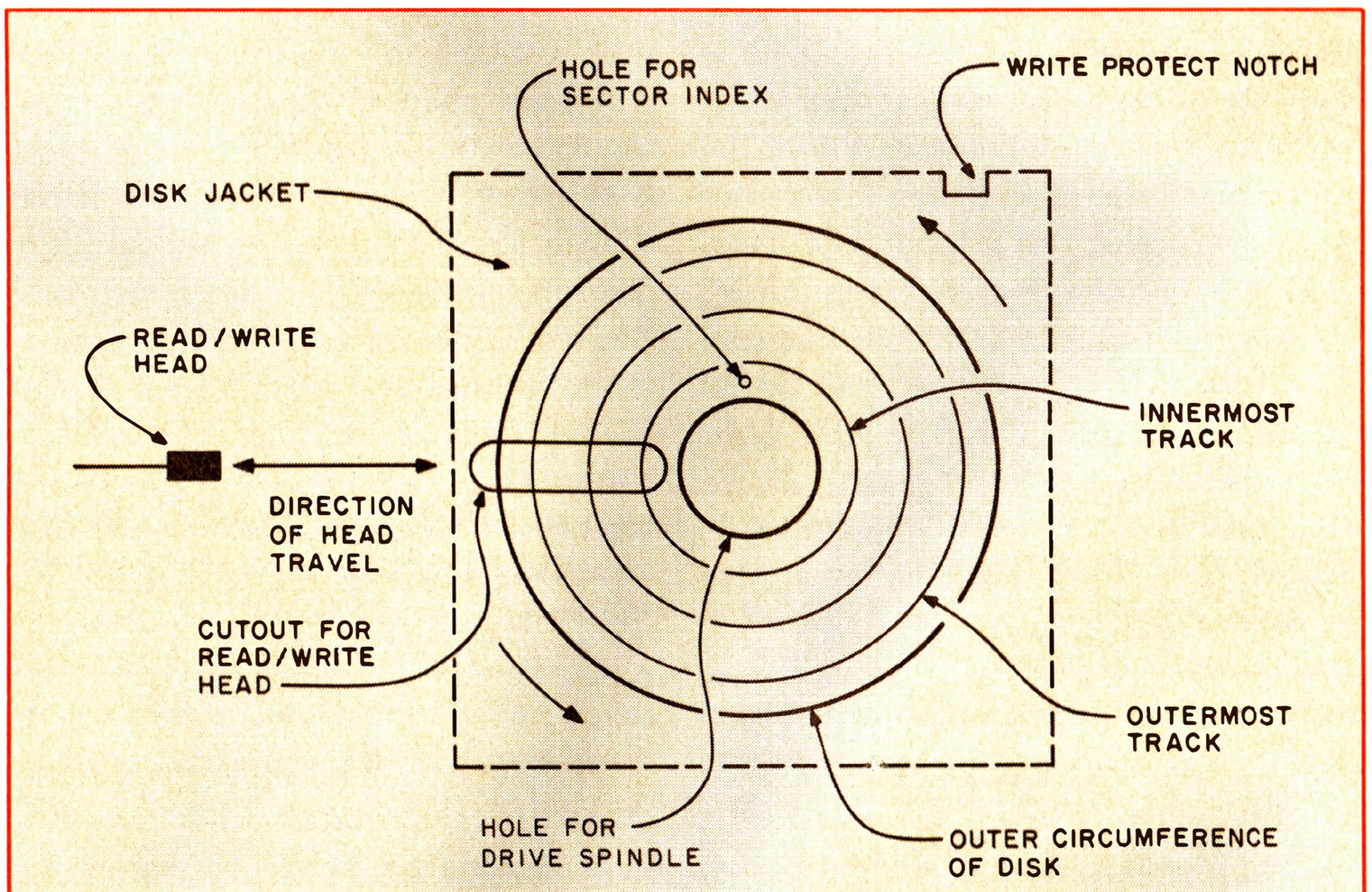


Figure 1: Anatomy of a disk. The read/write head is inside the disk drive; it moves back and forth across the disk to read or write data on the disk tracks. The disk rotates so that every sector on a track passes under the read/write head.

Columnist William Barden, Jr. is a writer and computer consultant in Mission Viejo, CA.

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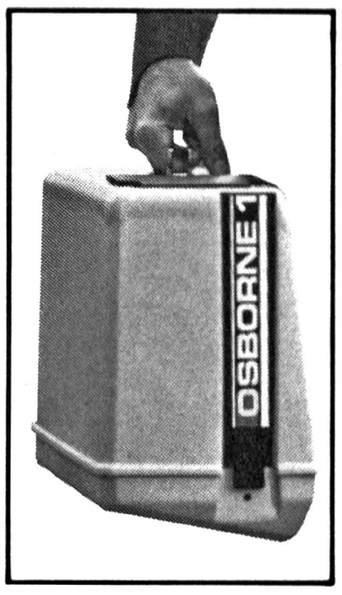

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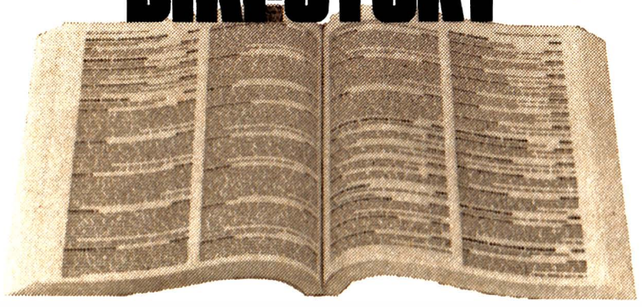

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typical 8-inch disk holds 250,000 to 500,000 per side. Each byte roughly corresponds to one character of data, so 90,000 bytes can hold about 80 double-spaced typewritten pages and 500,000 bytes can hold 440 double-spaced pages.

Cassettes vs. Disks

If you're currently using a cassette with your computer, you know that programs and other data are read "sequentially" from the tape. You have to start the tape at the beginning, wait until the computer finds the right file, then wait until the computer reads in the data or program. With a 90-minute cassette, the process can be quite time-consuming; in the worst cases, it takes longer than retyping the program would.

With a disk drive, however, data can be read or written at random. *Random access* means that any sector can be found by the disk drive in less than a second by positioning the head over the track and waiting until the proper sector spins under. Random access translates to a very practical benefit: the disk drive offers a way to store and retrieve data in seconds rather than minutes. No operator intervention is needed. You don't have to position a cassette tape at the proper point, then switch to another cassette for the next program. Disk drives give the computer the power to run programs automatically; they also speed up the overall efficiency of the system.

System Disks and Data Disks

Early microcomputers used disk operating systems to perform automatic program loading and other basic functions. Over the years, however, disk operating systems have become much more complex to keep pace with hardware advances.

When you buy a disk system for your small computer today, you'll get a *system disk* as part of the package. This disk will contain the DOS and several other special programs, all of which require space on the system disk—sometimes more than 70K bytes. On a disk having only 90K bytes of raw storage, that doesn't leave a great deal for your own programs and data. To the rescue come *data disks*. A data disk contains very little system software, so virtually all its space is available for your use. The catch is, with most small computers, data disks can be used only in multidrive systems. One drive must

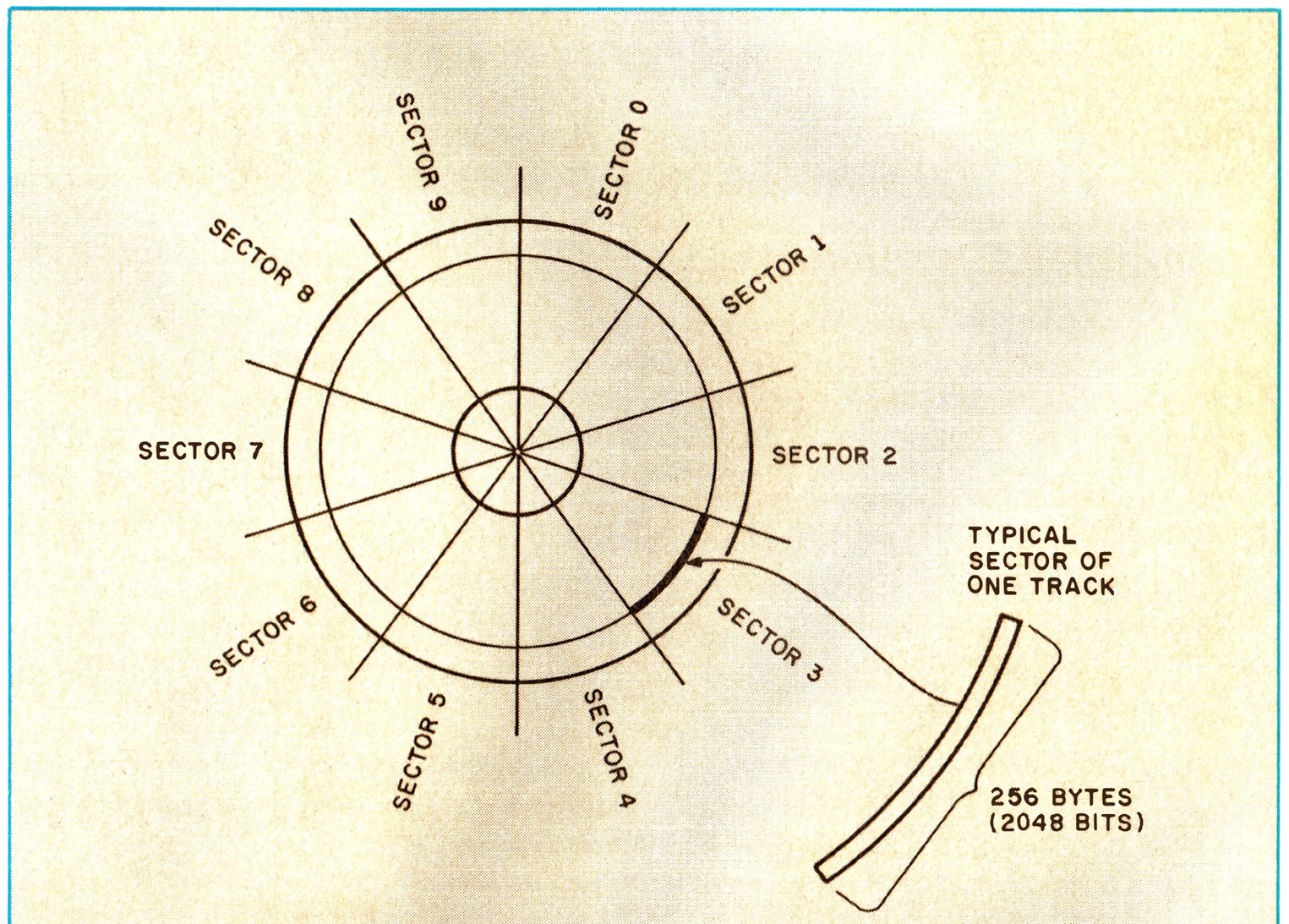

Figure 2: A typical arrangement of sectors on a track. In this example, one sector contains 256 bytes of data.

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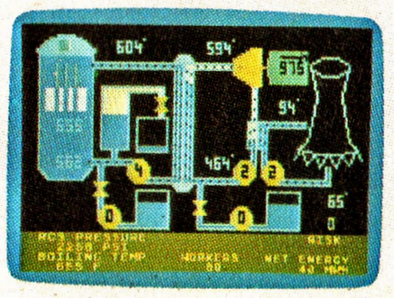

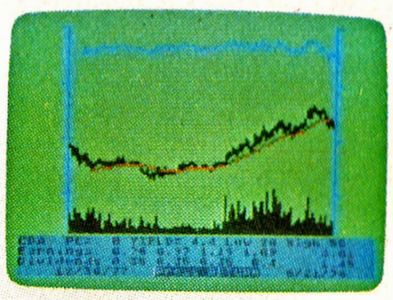

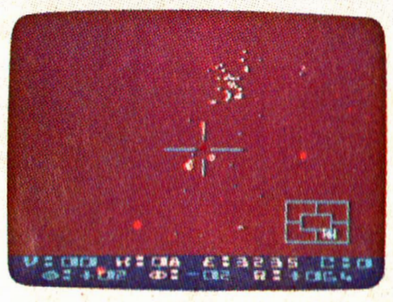

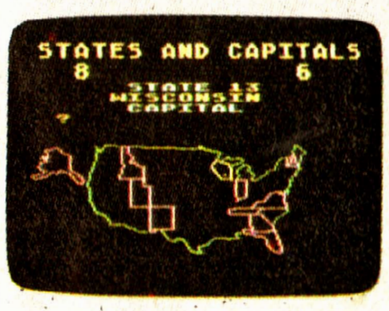

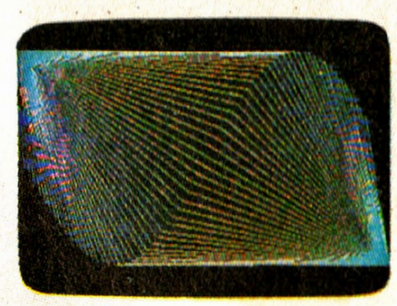

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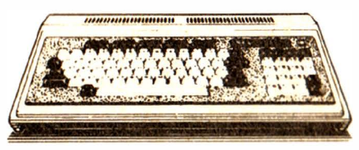

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always contain the system disk while the other drives contain data disks.

Why, you might ask, can't the computer load the entire DOS into memory? Then you could remove the system disk and load an ordinary data disk into your single drive. The answer: the average DOS is too big to fit into the computer's memory and still leave room for your own programs and data. Only a small portion of the DOS can be loaded into memory at any given time. When one portion or *module* is no longer needed, another is loaded into the same area. This is called an *overlay system*. It's an efficient way to use memory, although it does mean that the DOS disk must always be online (i.e., in one of the drives).

In most popular disk operating systems, there are five functions: loading and storing programs, loading and storing data files, file maintenance, utility programs, and input/output (I/O) handling.

Loading and Storing Programs

Probably the most important function of all disk operating systems is to provide an easy way to load and run programs. Usually, loading a program simply involves typing in its name. For example, when your computer displays a message such as DOS READY, you type BASIC and press Enter to start the BASIC interpreter. Or you might type INVEN, then press Enter to load and run an inventory-control program. (That's a lot easier than rewinding a cassette tape, adjusting the volume, pressing Play, then typing CLOAD and hoping the program will load.)

With systems such as CP/M (Control Program for Microprocessors by Digital Research), you receive a standard set of programs—editor, debug package, assembler, BASIC interpreter, and so forth. These are already on the DOS disk and can be called by typing their names. With other systems, you may have to add these kinds of programs to the DOS disk.

If your DOS includes a disk BASIC interpreter, you can easily keep your own programs by using a BASIC command such as SAVE "MYPROG". The program you have typed in will then be stored on the disk under the name MYPROG. Later, you can load and run this program by starting the BASIC interpreter and typing RUN "MYPROG".

Loading and Storing Data Files

A second important function that a DOS provides is the ability to store and read *data files*. A *file* is a collection of related data. Units of information in the file are called *records*. For example, the telephone directory for a small town might be stored in a single file; one record from this file would probably consist of a name, address, and phone number.

> A disk drive can store and retrieve large amounts of information in seconds rather than minutes.

Complex programs may use several data files at once, as all can be created, updated, and read in seconds. This *file management* capability is one of the most powerful features of disk operating systems. Files for programs or data are automatically handled by the DOS. Entries are made in the disk directory, disk space is allocated, old entries are deleted upon command, and so forth. In some operating systems, several different *file structures* may also be included. These consist of sequential files, where records are read from beginning to end; random files, where any record may be read without going through preceding records; and other, more complicated structures.

File Maintenance

Since file management constitutes a large portion of DOS activity, each DOS has a number of commands directly related to disk files. The disk file directory can be listed on the dis-

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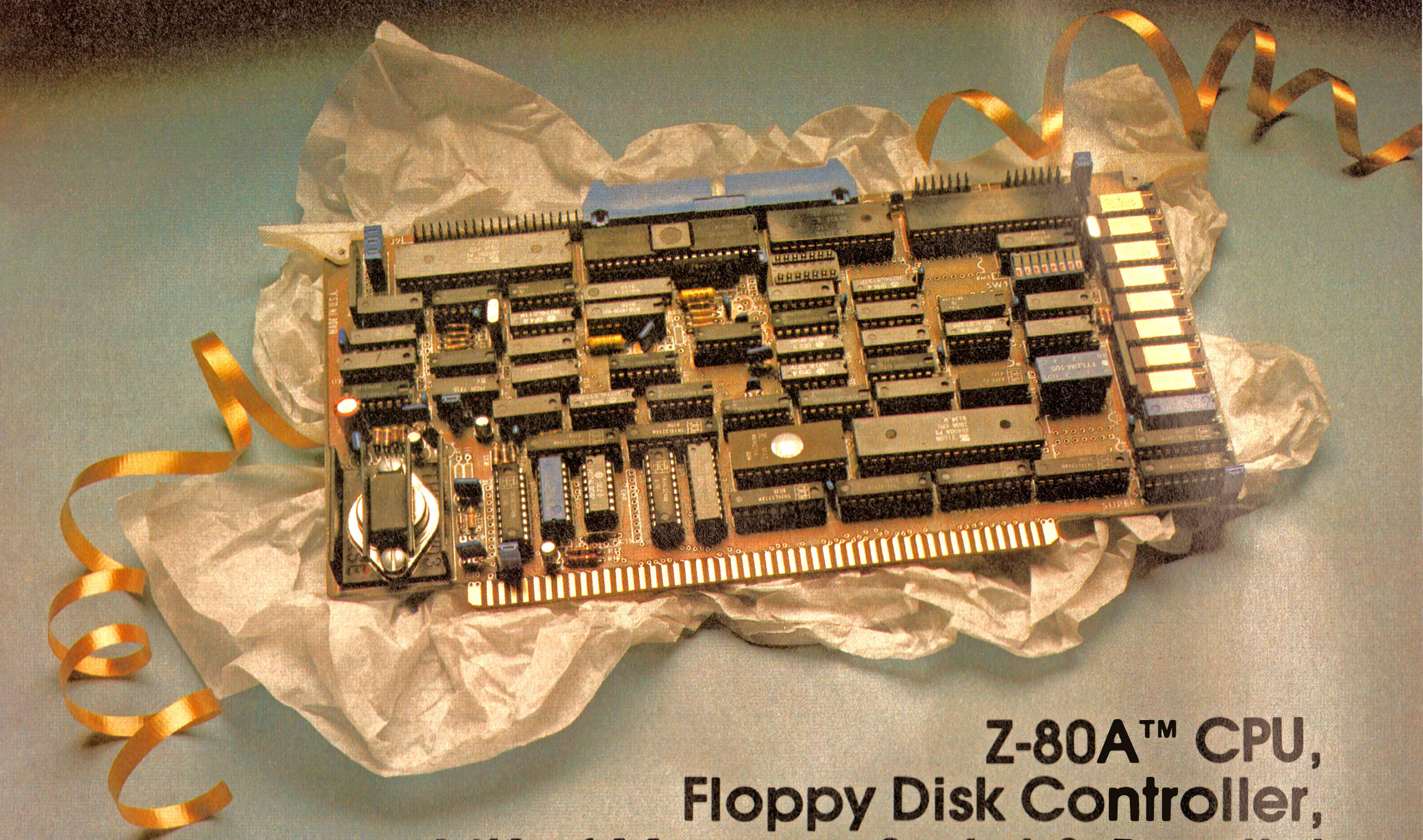

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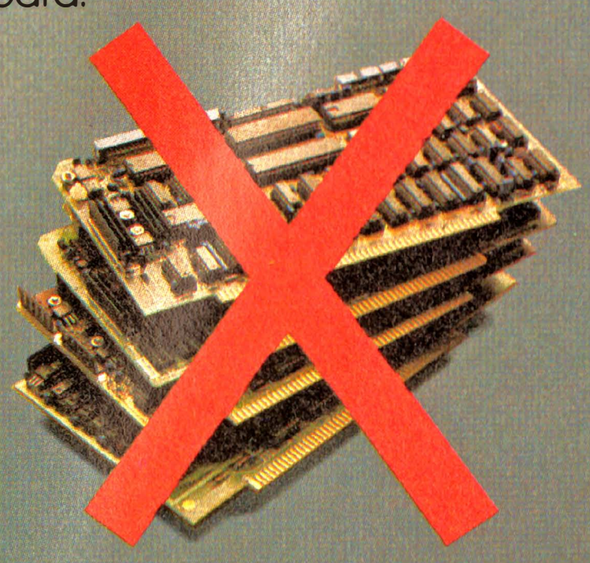

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Listing 1: A typical disk directory showing name, attributes, size, and last modification date of every file on a disk.

```
Free space =      31.2 K      Drive 0      LDOS - 5.0—10/13/81

Filespec Attributes Prot    / LRL #Recs / Ext File Space Mod Date

BOOT/SYS SIP      EXEC  / 256     5 / 1 S=    1.2 K
SYS6/SYS SIP      NO    / 256    41 / 1 S=   11.2 K 01-Aug-81
SCRIPSIT/LC       ALL   / 256    44 / 5 S=   11.2 K 13-Oct-81
ART1013/POP +     ALL   / 256    70 / 1 S=   17.5 K 13-Oct-81
DIR/SYS SIP       READ  / 256    10 / 1 S=    2.5 K
SYS0/SYS SIP      NO    / 256    17 / 1 S=    5.0 K 01-Aug-81
SYS8/SYS SIP      NO    / 256     3 / 1 S=    1.2 K 01-Aug-81
SYS1/SYS SIP      NO    / 256     5 / 1 S=    1.2 K 01-Aug-81
SYS2/SYS SIP      NO    / 256     5 / 1 S=    1.2 K 01-Aug-81
SYS10/SYS SIP     NO    / 256     3 / 1 S=    1.2 K 01-Aug-81
SYS3/SYS SIP      NO    / 256     3 / 1 S=    1.2 K 01-Aug-81
SYS4/SYS SIP      NO    / 256     5 / 1 S=    1.2 K 01-Aug-81
```

play or system line printer by a command such as DIR (P). This type of directory list command is essential for most DOSes.

Files can be deleted (by a bellicose KILL), renamed (RENAME MYPROG TO HISPROG), copied from a disk in one drive to a disk in another (COPY MYPROG:0 TO MYPROG:1), or appended (APPEND MYPROG TO HISPROG).

Utility Programs

More powerful DOSes not only have the standard "support software" such as editors, assemblers, and BASIC interpreters, but they also have a number of "utility programs." These are programs which perform specialized but important functions. Utility programs are not part of the DOS itself but can be easily loaded from the system disk.

Disks from the manufacturer are completely blank. Before they can store data, they must be *formatted*: tracks and sectors are defined, a disk directory is created, etc. The FORMAT utility performs this task.

Another utility provides a means to copy the entire disk onto another for a backup copy. It's a grim fact of life that computers have voracious appetites for late-evening snacks of magnetic material of all types. A BACKUP utility lets you keep "safe copies" of important disks.

Other utilities allow you to examine file contents, edit them, and perform more esoteric functions.

I/O Handling

One of the important functions of large-scale computer operating systems allows the programmer to handle input/output to different devices. The programmer need not be concerned with line-printer operation on a nuts-and-bolts level. We've seen how DOSes do this for disk files. Many of the more sophisticated DOSes also route data from one device to another.

> To delete a file, use the bellicose-sounding command KILL.

Suppose you want a report normally printed on a line printer to go to a disk file for later use. On some DOSes, it's possible to route the line printer output to a disk file. Other DOSes also *spool* line printer output to a disk file and print during slack periods in system operation, increasing the overall efficiency and speed of the system. Some DOSes, including CP/M, allow you to define your own *device driver*. This lets you control an odd peripheral device such as an early-model teletypewriter or a McHenry Pickle Bottle machine.

Another feature found in CP/M and other DOSes is the concept of *logical* and *physical devices*. The physical device is the actual input/output unit (e.g., a line printer or a video display). The logical device is the generic functional device, such as the "listing device" (LST). Logical and physical devices actually preceded the idea of routing and are offshoots of large-scale operating systems.

Automatic System Operation

Imagine giving your computer instructions to load BASIC, load your accounts-receivable program, run the accounts receivable by merging the latest transactions, print a report, then load and run a telecommunications program to automatically "dial up" and assemble stock market data. Now imagine all those instructions being followed without operator intervention!

It *is* possible. On mainframe computers, it's standard operation. On small computers, automatic system operation is more of a novelty than a practical requirement, but here's how it's done. First create a file containing the commands to be executed in the specified sequence (often called a *job control file*). Then command the computer to "do" the job control file. As long as nothing goes wrong during the execution of your prepared commands, the entire sequence will be performed automatically. You don't even have to be there to oversee.

Multiprogramming

The preceding discussion describes single-user systems. A number of DOSes, however, can accommodate several users or run several jobs concurrently. You could, for example, be compiling a FORTRAN program while running a BASIC inventory program. The advantage? During the huge (in microprocessor terms) amount of time spent waiting for the next character to appear on the line printer, a second or third task is executed. This *overlaps* computer program execution with printer, disk, and other I/O and increases total efficiency of the system.

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Cardcages 31
Cardguides 31, 96
Circuit Evaluators 23, 24
CMOS 10
Computer Paper 93
Computers, Singleboard 41,61
Computers, Systems 41-59, 79, 95
Connectors 20
Controllers 49, 53, 65
CPU Boards 62
Crystals 18
DIP Plugs & Jumpers 16, 22
Electronic Gadgets 84
Fans 96
Floppy Disks 92
Frequency Counters 34, 35, 37
Fuses 15
Headers 23
Heatsinks 12
Home Protection Devices 85
IC Test Clips 23, 33
Interface Boards 46, 48-49, 63, 64
Interconnectors 22
Intraswitches 22
Function Boxes 96
Keyboards 72
LEDs 11
Linear ICs 6-7
Low Power Schottky Devices 9
Magnetic Tape Cassettes & Cartridges 92
Mainframes 66
Mass Storage 51, 52, 66, 68-71
Memory 63
Microcomputer Components 1-5
Multimeters 36
Opto-electronics 11
Oscilloscopes 36, 39
PC Boards 30, 32, 33
Plotters 77
Potentiometers 19, 96
Power Systems 40
Printers 46, 50, 51, 74-76
Printer Ribbons 90
Printwheels 91
Prom Development Systems 14, 67, 69, 54
Resistors 14, 15
Robots 78
S-100 Computer Components 62-67
Sockets 16, 21
Software 42-57
Solder Equipment 25, 26
Storage Systems 94
Switches 18, 96
T-Shirts 96
Terminals (video) 73
Terminals (wire wrap) 32
Terminal Ships 23, 33, 96
Test Equipment 34-39
Tools 27, 28, 29
Toys & Games 82-86
Transistors 12
Transistor Arrays 11
Video Boards 52, 53, 65
Voltage Regulators 7
Wire 23, 28, 29, 33
Wirewrap Equipment 28, 29, 32

Manufacturer Index

ABT 53
Adds 73
Alpha Syntauri 49
Ampex 73
Anadex 50, 75
A P Products 22-24
Apple Computer 43-57
Atari 60
Beckman Instruments 19, 39
BPI 47
BSR 85
Burndy 21
Buss 15
Byteuser 67
California Computer Systems 48, 49, 62-64, 66
Casio 83
Centronics 75
C. Itoh 75
Corvus Systems 51
Craig 84
Creative Microsystems 61
Diablo 50, 76, 90, 91
Digital Research Computers 41
Elpac 40
Epson 50, 74
E-Z Hook 26
Fidelity Electronics 85
Global Specialties 33-35
Godbout Electronics 62, 64, 65
Hayden 55
Hayes Microcomputer Products 48
Hewlett-Packard 79-81
Hickok 38
Houston Instruments 77
HSS 47
Hunter Tools 27
IBM 92
Indy 85
Integral Data Systems 50, 74
Interactive Structures 49
Intersystems 40
Isotip 25
M & R Enterprises 53
Malibu Electronics Group 50
Mattel 86
Maxell 92
Microbot 78
Micropro International 54
Microsoft Consumer Products 49, 55
Microstand 48
Morrow Designs 63, 64
Mountain Computers 48, 49, 53
MPI 70-71
Mullen 65, 67
NEC 75, 76, 90, 91, 95
NLS 36-37
NNC Electronics 66
Novation 48
NSC 83
OK Machine & Tool Company 28-29
Osborne/McGraw-Hill 88-89
Otrona 95
Pace 84
Panavise 12
Peachtree Software 55
Personal Software 34
Processor Technology 67
Qume 70-71, 76, 90, 91
RCA 72
Rockwell 41
Scott Instruments 50
SD Systems 41, 62-65, 67
Sensible Software 47
Sharp 83
Shugart 70-71
Soroc 73
SSM 48-50, 62, 65, 67
Stellation Two 49
Stoneware Microcomputer Products 47
Sybex 87
Synergistic Software 57
Tarbell 64
TCS Software 55
TEI 66
Televideo 73
Texas Instruments 82
Thunderware 48
USA 55
UVP 14
Vector Electronics 30-32
Verbatim 92
Videx 53
Vista Computer Company ... 48-53, 68, 69, 70, 71, 76
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In another type of operating system, a *background* job, such as a BASIC compilation, could be run at the same time as a time-critical, real-time, *foreground* job, such as monitoring a nuclear reactor. The background job would be run after all pending foreground tasks had been processed. Still another type of operating system handles a *timesharing* system, serving many users over a telecommunication system.

All three advanced operating systems exist for some small computers, although the less sophisticated, single-user operating system is more than adequate for most popular computing applications.

Should you use a DOS? My personal feeling is that if you are attempting to do *anything* useful with your system, you should be using a disk with the accompanying DOS. If you're using your system only as a learning tool or for occasional games, then a DOS may be a luxury.

Which DOS is best? This question is easily answered for some small computer systems, as there may be only one DOS (or none) available. However, for the more popular microcomputer systems, several DOSes may be available. Radio Shack's Model I system, for example, has the standard Radio Shack TRSDOS, plus NEWDOS, LDOS, DOSPLUS, CP/M, and others.

CP/M has been adapted to a number of computers. Versions now run on Apple, Radio Shack, and other popular computers. It's an extremely successful system and has a large amount of software available.

When multiple DOSes are available for your system, use the same caution as in buying software. Evaluate the size and stability of the manufacturer, support from the supplier, and documentation. Also look for compatibility of the DOS with other DOSes. Some DOSes won't accept disks generated by other DOSes, not even the original computer manufacturer's DOS!

Next month, we'll assume you've taken the plunge in disk systems and will discuss disk files. □

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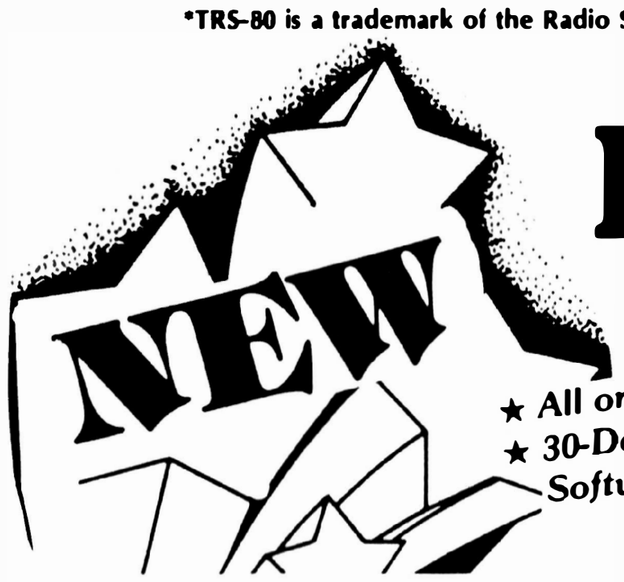

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7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model

NAME		DESCRIPTION
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker-
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
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Dedicated Word Processors vs. Microcomputers for Word Processing

Which Is Better for Your Business?

by Steve Ditlea

When it comes to word processing, today's microcomputers are late arrivals on the office scene. A full decade before microcomputer systems made their appearance, IBM coined the term "word processor" for its new breed of automated text-editing machinery. Though expensive and primitive by current standards, office machines dedicated solely to word processing soon found many applications—from contracts to the "personalized" form letter.

Microcomputers benefited from floppy-disk-storage technology originally developed for dedicated word processors. Unlike their single-purpose predecessors, microcomputers could perform many useful tasks by merely substituting programs. Equipped with appropriate word-processing software, they could hold their own (at thousands of dollars less cost) against dedicated machines, opening the way for small businesses to implement time- and labor-saving automated document creation.

Lately, the distinction between dedicated word processors and microcomputers used for word processing has begun to fade. Prices have dropped to the point where a dedicated Wangwriter sells for approximately the same as a Radio Shack TRS-80 Model II microcomputer equipped with a letter-quality daisy-wheel printer and Scripsit, Radio Shack's own word-processing software. Both systems offer comparable editing features. Add the fact that the Wangwriter can double as a microcomputer by running CP/M-based software and it becomes difficult to distinguish between what were once hard-and-fast categories.

For the moment, most dedicated word processors remain single-purpose office machines. As a result, they are designed with special keys and simplified editing commands to increase user efficiency. Some models offer full-page vertically oriented screens, while top-of-the-line models offer high-resolution video displays of documents exactly as they will print out in black type on a white field. Keyboards and other components are built to withstand constant use in an office environment; a word processor's innards might include gold-plated contact points for reliability, a feature not always found in microcomputer systems. Because they are intended as office machines, they are backed by on-site service contracts. All of this costs money. Though there are word processors available for $6500, the same price as microcomputers with letter-quality printers, most dedicated machines range from $8000 to $15,000. You may have to pay an additional $100 to $150 per month for a service contract.

Is a dedicated word processor worth almost twice the cost of a microcomputer used for word processing? Ira Mayer, music critic for the *New York Post* and a freelance writer for numerous publications, thinks so. Words are his business. When he went shopping for a word-processing unit for his Brooklyn office, he surveyed the entire field and tried a number of systems before settling on a Digital Equipment Corporation word processor selling for $10,000. "With an Apple, you needed more keystrokes to perform the same editing functions," he recalls.

The price differential now seems moot: "My word processor paid for itself in less than a year," Mayer explains. "I had a full-time secretary to help me edit and rewrite, but I no longer need anyone: I never have to retype things." Among the time-saving features he employs are communications programs that allow him to transmit stories directly to the *Post* or England's *Music* and *Video Week* via telephone and telex lines.

As Mayer quickly learned, visits to local sales offices can provide valuable information on the peculiarities of dedicated word processors. However, unlike microcomputer retailers that encourage off-the-street inquiries, word-processor manufacturers enjoy playing hard to get. They demonstrate their machines only by appointment, and then only grudgingly, it seems. IBM, on the other hand, offers regularly scheduled three-hour seminars explaining the ins and outs of its Displaywriter word processors.

Despite special keys and custom features, the dedicated word processor is severely limited by its lack of compatibility with other makers' machines

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as well as with other models from the same maker. If you plan to exchange word-processing disks between employees or departments, you must purchase similar systems for all. In the absence of industry-wide standards, some word-processing manufacturers, including Xerox and Wang, have adopted programming languages and operating systems from microcomputer systems.

Most popular microcomputer models have built-in limitations when it comes to word processing, but ingenious software (and optional hardware) allow most microcomputers to keep up with dedicated word processors. For example, the factory-shipped Apple II is notorious for its inability to display lowercase letters or lines of more than 40 characters (80 characters are normal on an 8½-inch-by-11-inch document). With the addition of a plug-in 80-character board and appropriate off-the-shelf software, the Apple's display becomes virtually identical to that of a dedicated word processor. And with a simple connection and a bit of careful soldering, the Apple's shift keys will call up uppercase or lowercase letters. As for the Radio Shack TRS-80 Models I and III, they can only display 64-character lines, although, including margins, 64-character line widths can approximate the actual contents of a document.

A particular word-processing application is often easy to use because of well-designed software. With a dedicated word processor you might be confined to correspondence- or contract-oriented software, while programs available for microcomputers run the gamut from efficient text editors to letter-grade mailing-list packages. Depending on its actual use, a simpler (and less expensive) microcomputer word-processing package may prove superior to the one with all the fancy trimmings. To compose this column, for instance, Information Unlimited Software's Professional Easy Writer, a fine 80-character correspondence-grade program, proved slower for editing purposes than Apple's own spartan 40-character Apple Writer software.

According to Harvard Pennington, head of the publishing firm IJG Inc., a simple microcomputer word-processing program like the Electric Pencil, the first such program to be widely offered for the TRS-80, can be even faster and more efficient than a dedicated word processor, and a great deal easier to master. "Some word-processor manufacturers want you to go to school for two weeks to learn how to use their machines," he notes. "A simple word-processing program shouldn't take more than a few hours to learn." For this reason, his company has arranged to make Electric Pencil software available again after a year's hiatus.

Within Pennington's own firm, microcomputers have virtually eliminated paper as an editing medium. "Manuscripts for the books we publish are submitted on disk. We edit with Electric Pencil, then feed the disks to an Autologic y5 typesetter, which can set three hundred pages in an hour and five minutes. No dedicated word-processing system can give you that kind of flexibility."

Specialized capabilities vs. flexibility, reliability vs. economy, on-site maintenance vs. haul-it-yourself to the shop—these factors should all be weighed when considering the merits of a dedicated word processor or a microcomputer for your word-processing needs. The gap between them is narrowing, yet judging from demand across a wide spectrum of businesses, word processors and microcomputers will continue to sell to their own clearly defined markets. The Fortune 500 firms will opt for the expensive, discrete charms of word processors, while small businesses will increasingly take to microcomputers for word processing. A time and labor saver, by any name, will sound sweet to today's business user. □

Steve Ditlea is a New York-based freelance writer specializing in personal computers used in small businesses.

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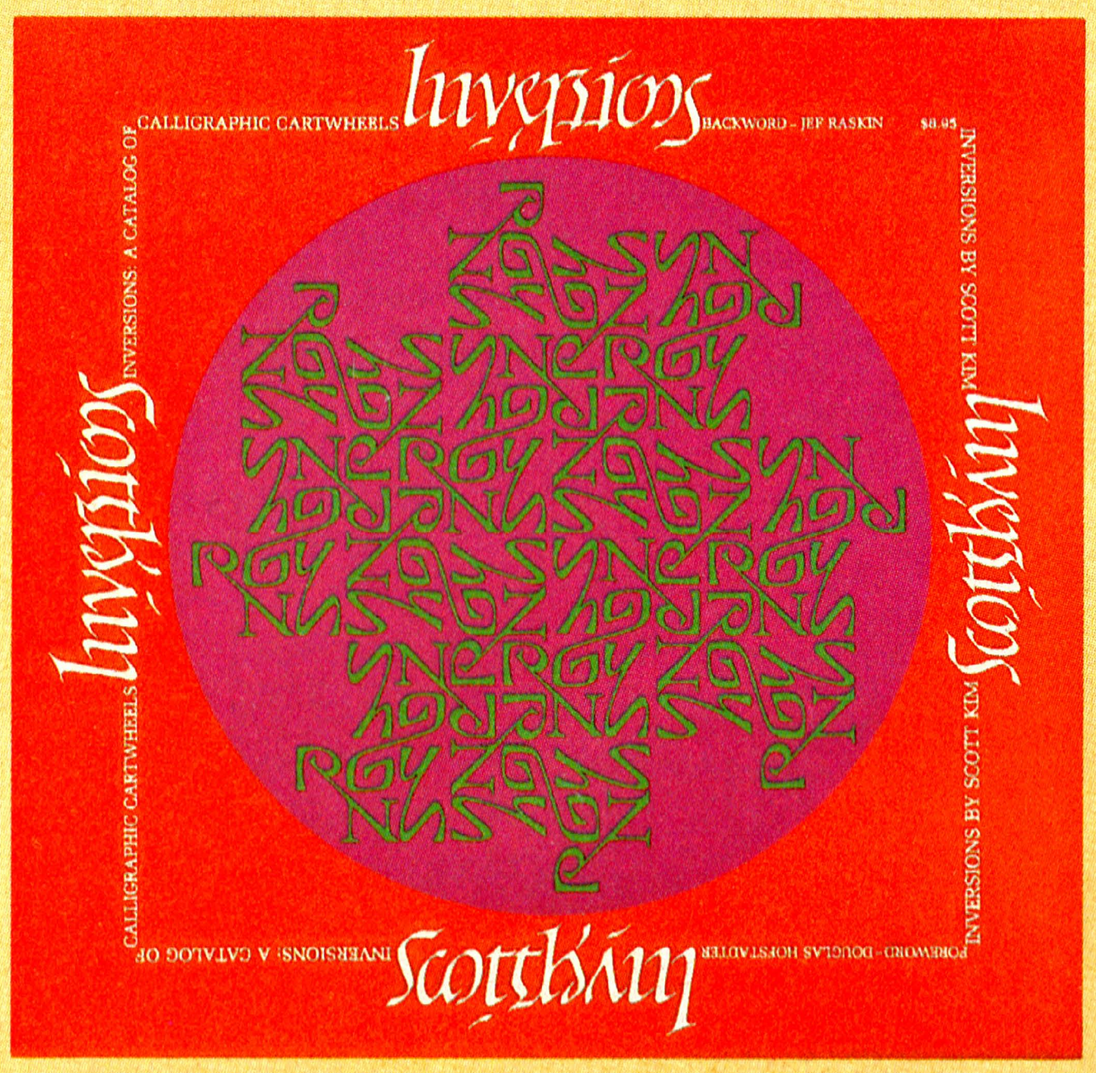

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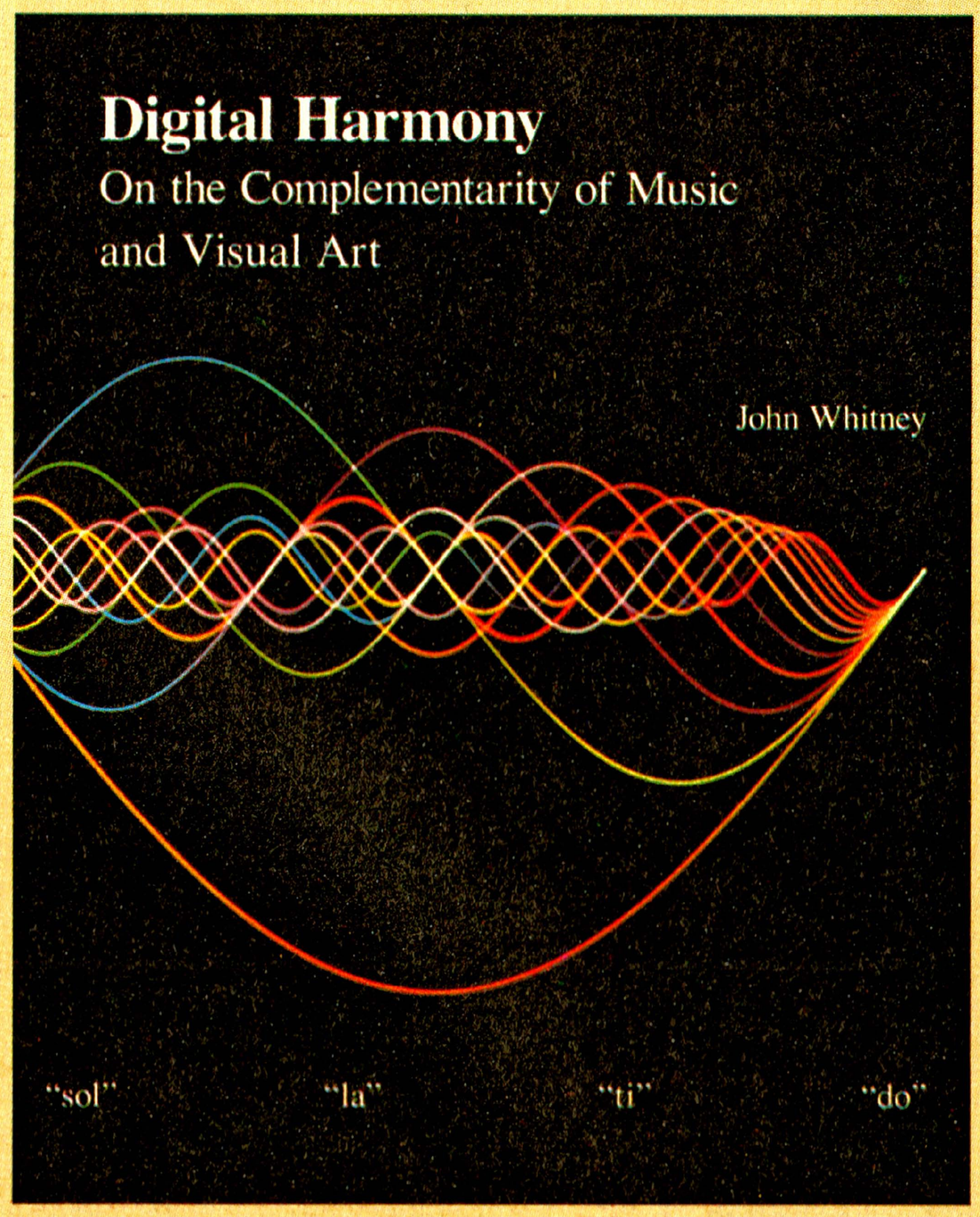

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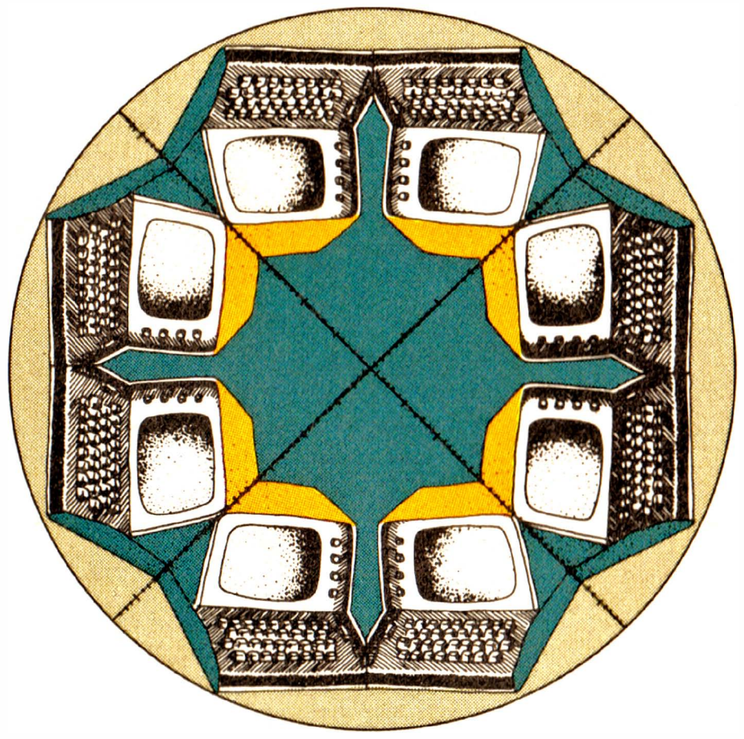

Compuserve

A Potpourri of Information Services

by Stan Miastkowski

In the last two columns, we've discussed The Source, based in McLean, Virginia. This month I'll take a look at another popular telecomputing service, Compuserve of Columbus, Ohio.

Compuserve is one of the world's largest suppliers of *timesharing* computer services to the business community. Through this system, a company of any size can hook up to Compuserve's computers via regular telephone lines and use large-computer power to do accounting, payroll, and other tasks. The majority of this activity takes place during normal working hours, and in the past, those large (and very expensive) computers stood virtually idle during off-peak hours, gobbling up huge amounts of electricity (as they must be kept running constantly).

To turn that idle time into cash, Compuserve started offering computer access to hobbyists during the slow hours. Thus was born Micronet. Offering specialized services such as program swapping and advanced programming, Micronet has been expanding since the first hobbyist hooked up to its computers. Compuserve, however, still vastly overshadows Micronet. Compuserve now claims to have more than 17,000 subscribers and expects to exceed 40,000 by 1983.

Unlike some of the other telecomputing services that require you to type in specific *commands* to access the particular area you want, Compuserve uses a *menu-driven* system. With this type of system, you're given a list of numbered choices. All you need to do is type in the number to access your choice. Menus are usually *nested*, which means that when you choose a general area, you're given another list of numbered choices to further narrow the field.

There's an ongoing, lively debate among computer users as to which is better, the menu-driven or the command-driven system. Each has its advantages and disadvantages. The menu-driven system is much easier for beginners but becomes time-consuming for experienced users. The command-driven system allows direct access to a specific area of interest without dealing with nested menus; however, it's much more confusing for beginners.

Compuserve also divides data into *pages*, each of which is assigned an identifying number. Once you're familiar with the system, you can circumvent the nested menus by typing GO and the page number. One little annoying characteristic of Compuserve is that you must press Enter after each page is displayed. Unlike some other services, there's no way to tell the system to keep feeding material continuously. (You won't have time to get a cup of coffee and a sandwich while your printer is handling a long story.)

Compuserve, which has scheduled many new services for coming months, is designed to attract users with a wide variety of interests. Detailed descriptions of its services would fill this entire magazine, so let's just look at the highlights.

NEWSPAPERS, a must for news hounds, covers ten national newspapers. Their entire texts are available to you the same day the papers "hit the streets." Also, if your tastes run toward even more up-to-the-minute information, you can access the Associated Press news wire.

FINANCE presents a considerable range of reports and services aimed at those interested in stocks, bonds, and commodities. Also included is Standard and Poor's News, a comprehensive business news service. (For budding entrepreneurs, it's the *only* way to keep up with what's going on.)

ENTERTAINMENT, for obvious reasons, is one of the most popular areas of Compuserve. Included are a number of games, movie reviews, current information on videotape and videodisc hardware and software, a tongue-in-cheek advice column called "Ask Aunt Nettie," and a CB simulation. The CB simulation, we're told, accounts for over 50 percent of Compuserve use. Not unlike "Chat" on The Source, it allows you to communicate with other users logged on to Compuserve. It attracts a varied group of people and can be an interesting diversion.

COMMUNICATIONS offers electronic mail (you can leave messages for

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Stan Miastkowski is the managing editor of Popular Computing.

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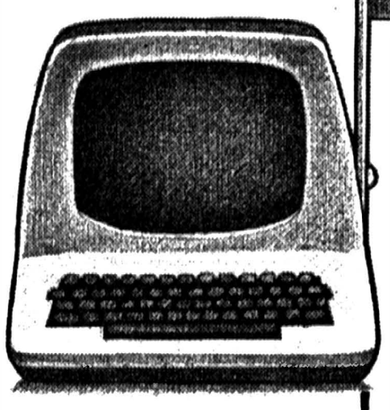

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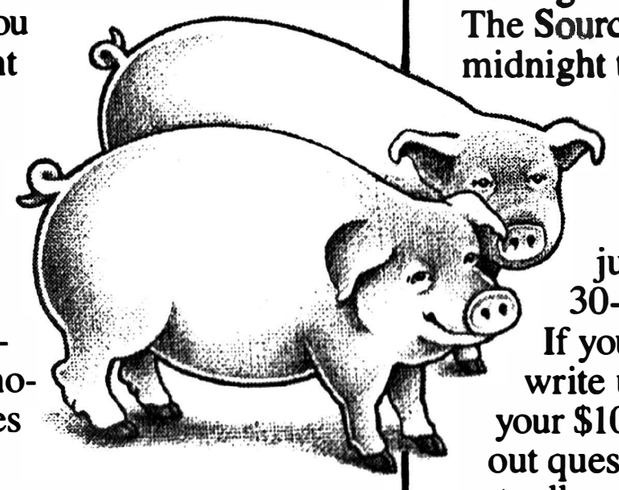

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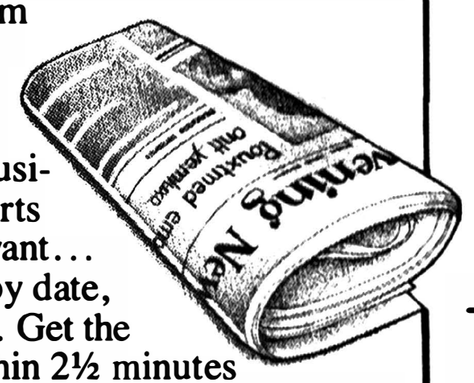

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COMPUSERVE USER INFORMATION, the clearing house for any and all information about Compuserve, tells you what's new, what's available, how to use it, and how much it'll cost.

SPECIAL SERVICES contains a great deal of special-interest material, including, for example, the latest safety and product information for private and commercial aircraft pilots. Most popular are the Atari and Tandy newsletters.

HOME INFORMATION offers (as this article was written) portions of *Better Homes and Gardens*, *Popular Science*, and an index of U.S. government publications. The Compuserve people regard these "electronic magazines" as increasingly important and are actively working to recruit other publishers.

EDUCATION poses sample questions to prepare you for college boards and the GRE (Graduate Record Exam).

PERSONAL COMPUTING offers, among other things, a service through which you can swap information with users.

MICRONET, Compuserve's original personal-computer user's service, is a completely separate part of the database. It was designed for those who have an intermediate-to-advanced knowledge of software and programming. Micronet provides access to the full capabilities of large DEC (Digital Equipment Corporation) computers. Because there are so many functions to choose from, the company offers a number of manuals on sections of Micronet.

What Does It Cost?

Compuserve is available from 6 p.m. to 5 a.m. (local time) on weekdays and all day Saturday and Sunday. The basic charge during this time is $5 per hour, but there's a minimum charge of $10 a month. The company has local phone numbers in most metropolitan areas, eliminating the need for an additional "network" charge. In many locations, you'll need to use Tymnet to access Compuserve. That's an additional $7 per hour. (Unlike many of the other services, Compuserve can't be accessed through Telenet.)

If it sounds like Compuserve might be for you, you can obtain further information and an application for service by contacting:

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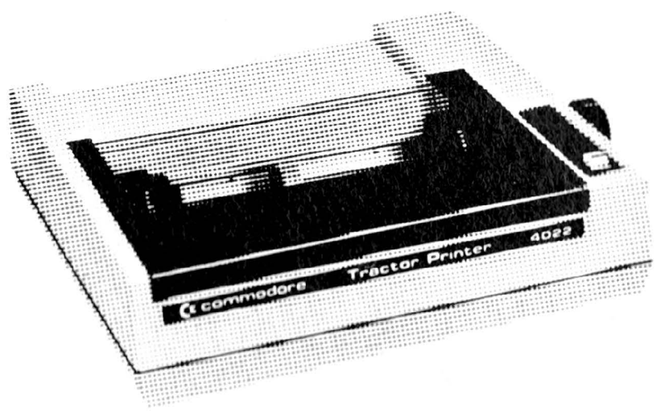

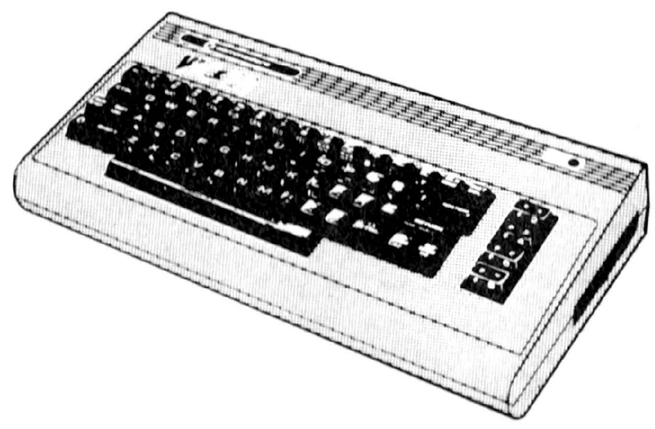

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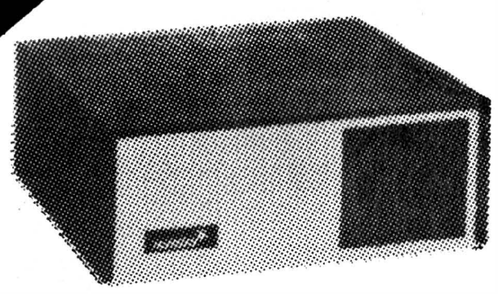

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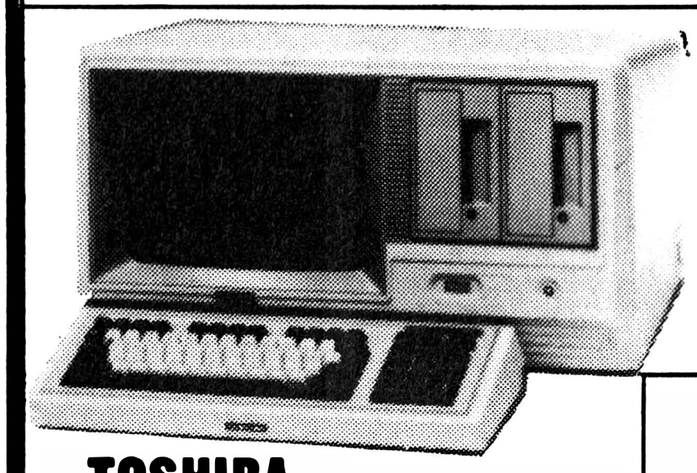

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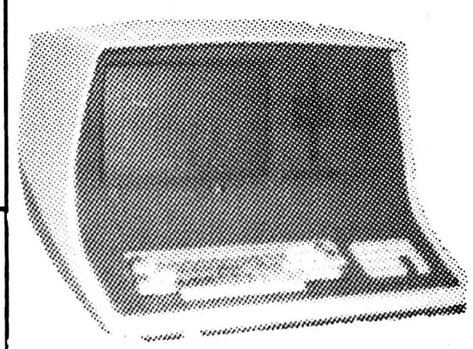

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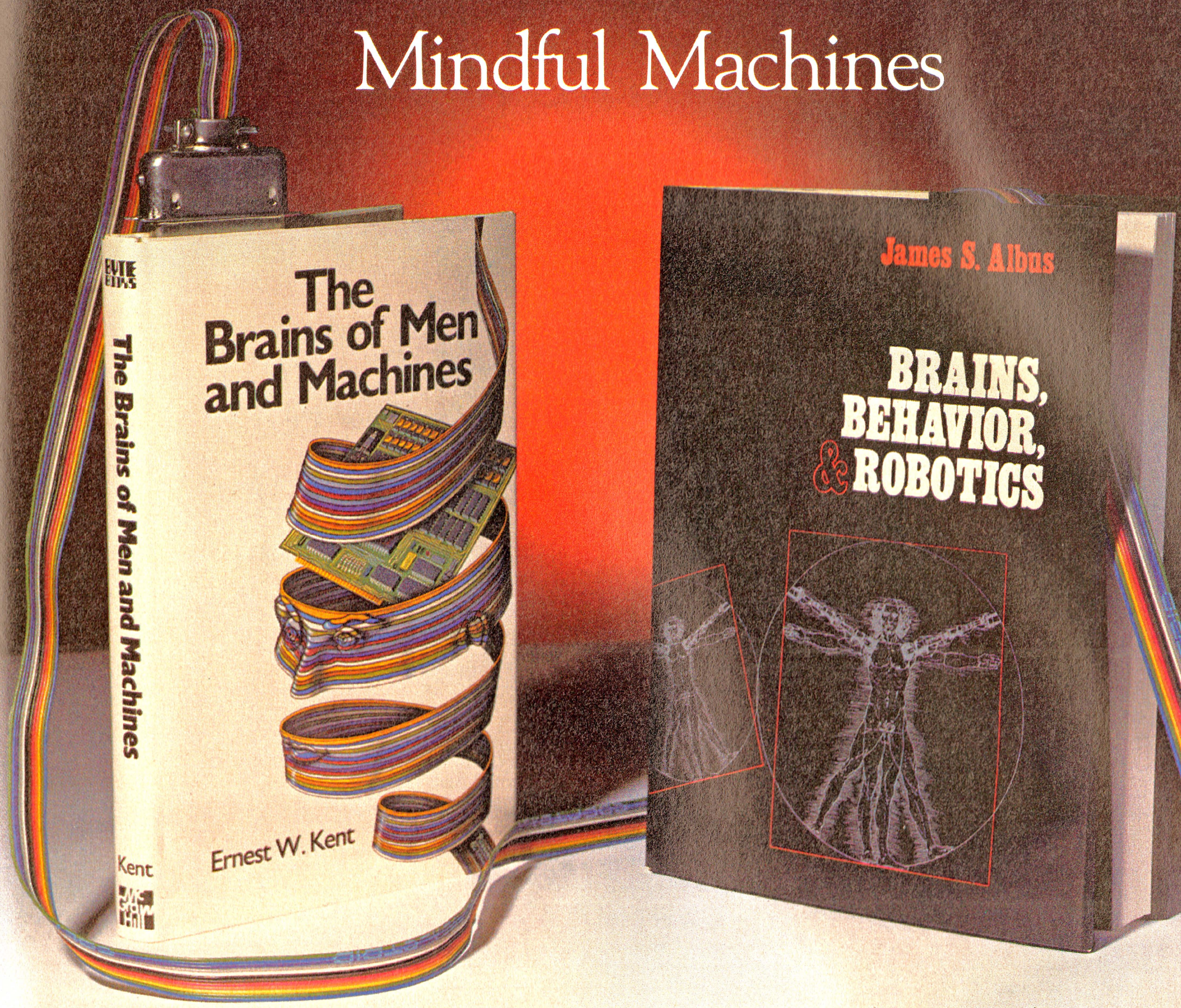

On the leading edge of the current technological revolution, these two books are written by modern thinkers who, like the Renaissance sages of an earlier time, venture across the boundaries of traditional disciplines to create vivid, detailed studies of humanity's quest for self-contained thinking machines.

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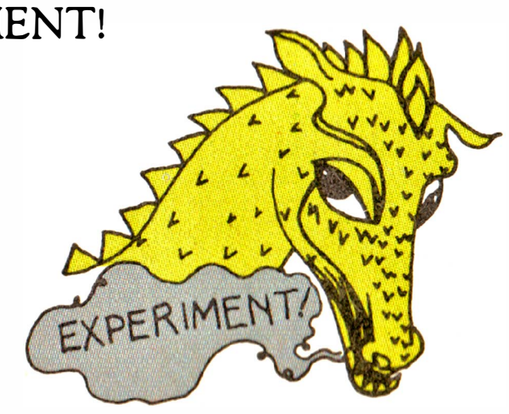
BYTE BOOKS

Future Play

by George Firedrake and Ramon Zamora

"My Computer Likes Me" is for adults and children who want to learn to use, program, and enjoy the TRS-80 Color Computer together. These ideas are best used when a kid asks, "How does the computer do that?" or "How can I make the computer do what I want it to do?" or "Can the computer tell me (whatever)?"

If you have a TRS-80 Color Computer, grab a bunch of kids and help them enjoy—and learn to understand—simple programs in Color BASIC by explaining what is happening, answering questions, modifying our ideas, and enriching the adventure with your own ideas. Don't do the typing. Let the kids do the hands-on stuff. Be patient—let them make mistakes, correct their own mistakes, and encourage them to EXPERIMENT!



We assume you can explain how programs work. If you have trouble with some of our programs, let us know or consult *TRS-80 Color BASIC* by Bob Albrecht.

Mandala

A mandala is a symmetric pattern like a snowflake. Snowflakes are beautifully symmetric and great mandalas, but they melt too soon. Use this program to put an ever-changing mandala on the screen.

```
100 REM ** MANDALA, EVER CHANGING
110 CLS 0

200 REM ** HORIZONTAL & VERTICAL OFFSET
210 H = RND(32) - 1
220 V = RND(16) - 1

300 REM ** RANDOM COLOR
310 KOLOR = RND(8)

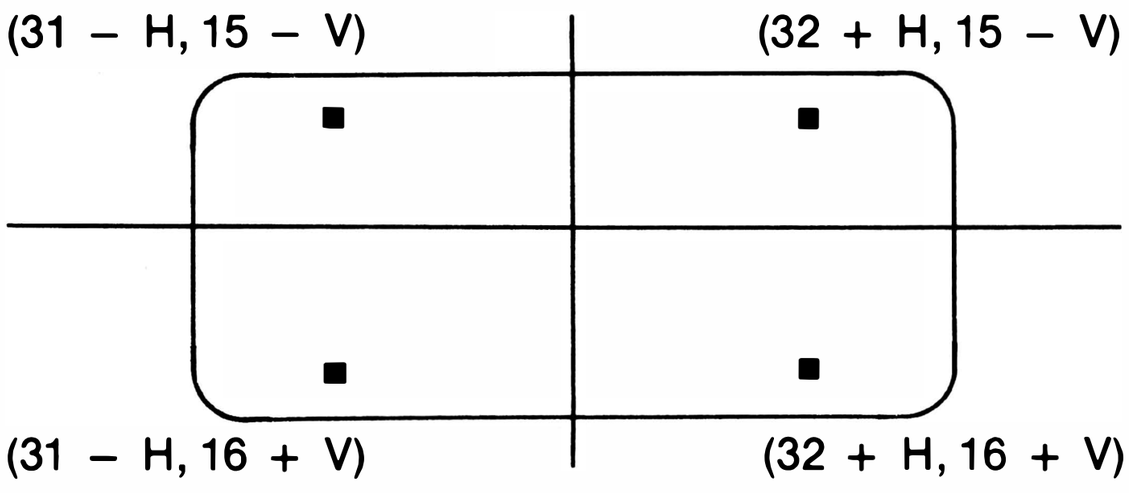
400 REM ** TURN ON 4 BLIPS
410 SET(31 - H, 15 - V, KOLOR)
420 SET(31 - H, 16 + V, KOLOR)
430 SET(32 + H, 15 - V, KOLOR)
440 SET(32 + H, 16 + V, KOLOR)

500 REM ** IF NO KEY PRESSED, GOTO 210
510 IF INKEY$ = "" THEN 210

600 REM ** WAIT FOR KEY, THEN GOTO 210
610 IF INKEY$ = "" THEN 610
620 GOTO 210
```

Enter the program and **RUN** it. A symmetric pattern begins growing on the screen. Press any key and the pattern stops. Press another key and the pattern continues growing. To start over with a new pattern, press **BREAK**, then **RUN** the program again.

Block 400 puts four symmetric blips about the center of the screen.



To see this happening, put a time delay with the following statements at the end of block 400.

```
450 TT = 460
460 FOR KK = 1 TO TT: NEXT KK
```

This gives a time delay of about one second. Change the value of TT in line 450 to increase or decrease the time delay.

Remember our buzzword—experiment! Try these variations:

George Firedrake (alter ego of Bob Albrecht) and Ramon Zamora are regular columnists for Popular Computing.

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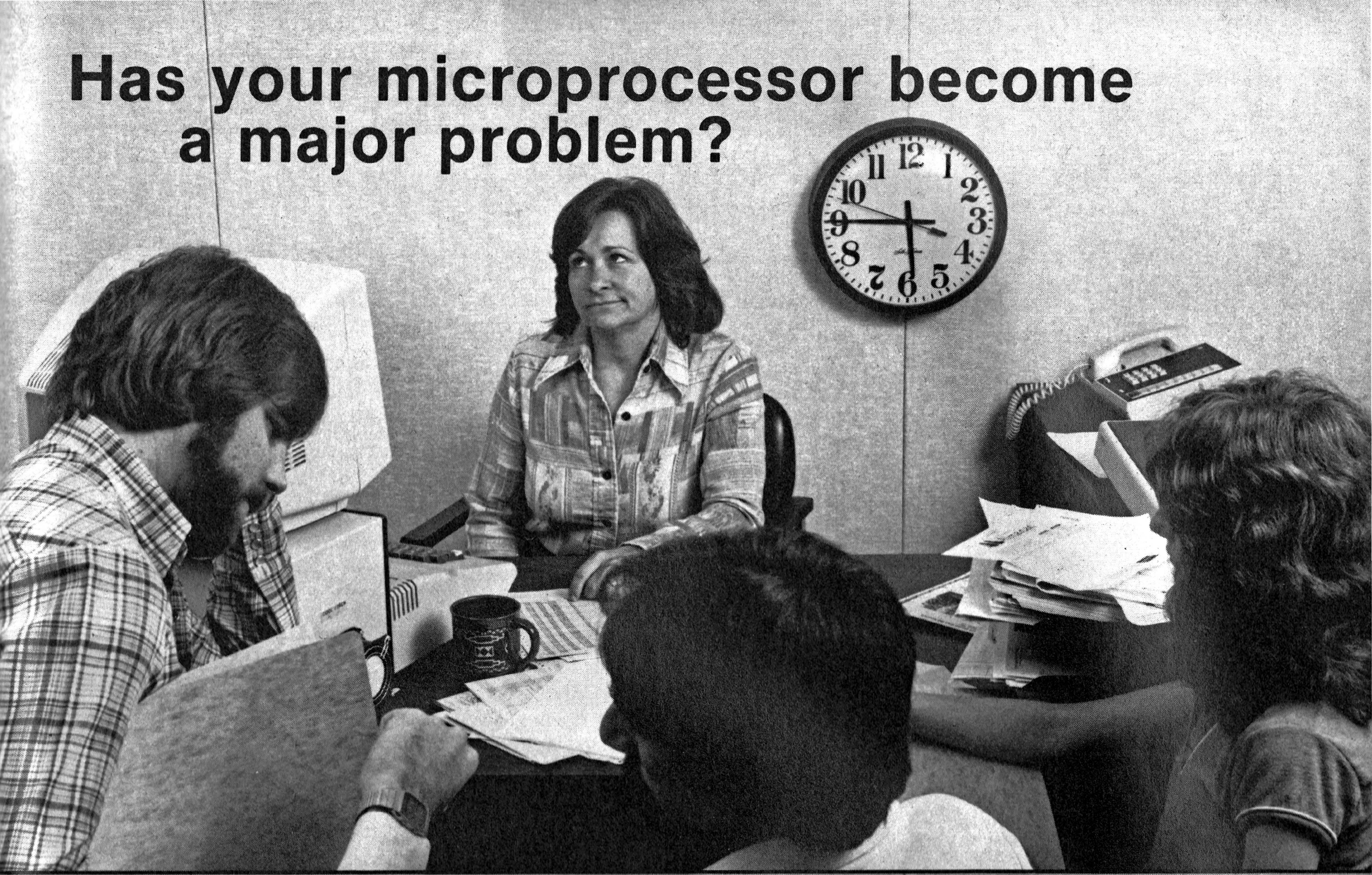

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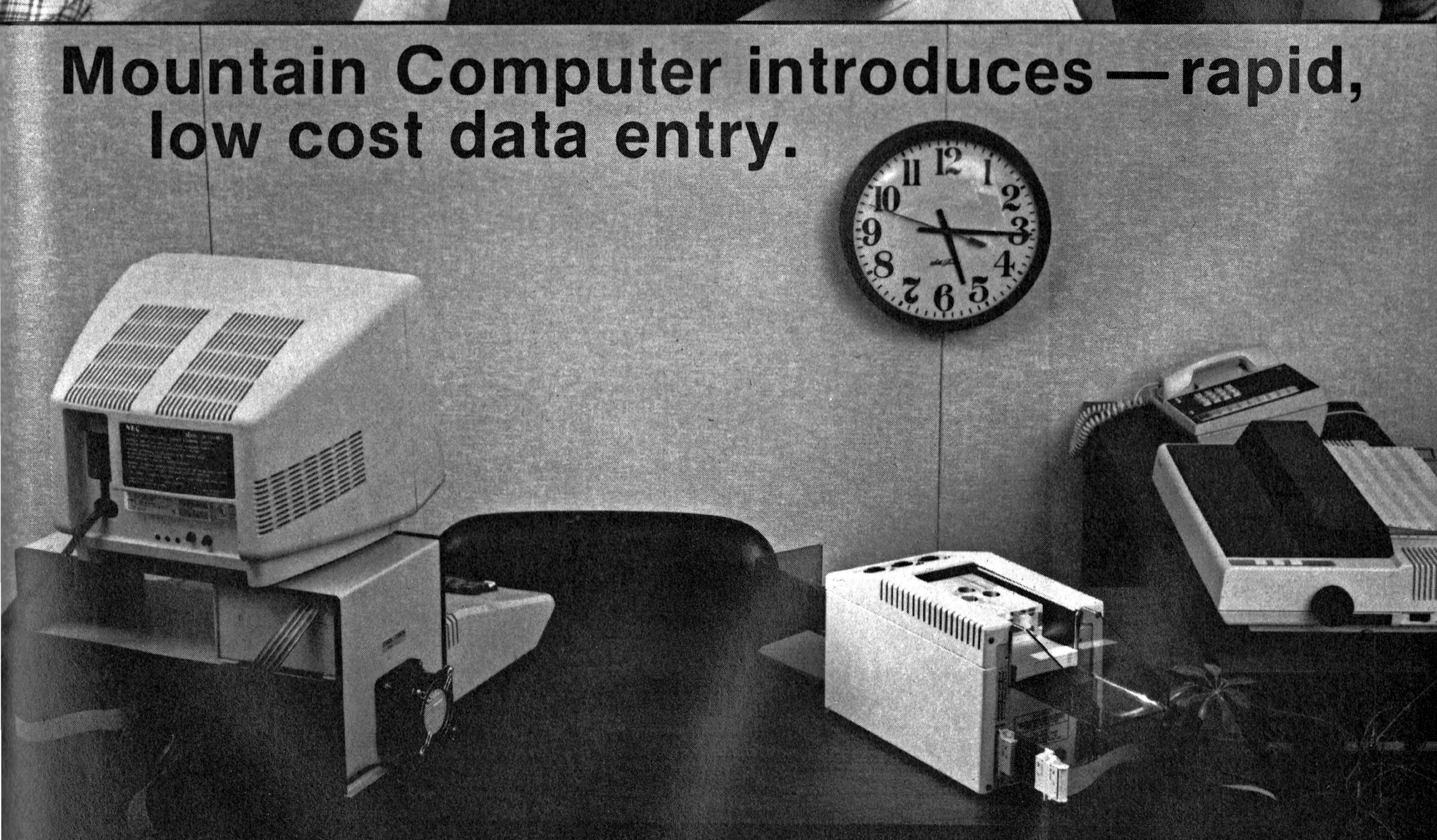

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Variation 1. Change *only* line 210, as follows:

```
210 H = RND(RND(32)) – 1
```

Variation 2. Change *only* line 220, as follows:

```
220 V = RND(RND(16)) – 1
```

Variation 3. Change *both* lines 210 and 220, as follows:

```
210 H = RND(RND(32)) – 1
220 V = RND(RND(16)) – 1
```

Variation 4. Change *either* line 210 or line 220, or both, as follows:

```
210 H = RND(RND(RND(32))) – 1
220 V = RND(RND(RND(16))) – 1
```

Variation 5. Change *either* line 210 or line 220, or both:

```
210 H = 32 – RND(RND(32))
220 V = 16 – RND(RND(16))
```

Now try this version of Mandala, Ever Changing:

```
100 REM ** MANDALA, EVER CHANGING
110 CLS 0

200 REM ** HORIZONTAL & VERTICAL OFFSET
210 H = RND(RND(32)) – 1
220 V = RND(RND(16)) – 1

300 REM ** RANDOM COLOR
310 KOLOR = RND(8)

400 REM ** OFF (1) OR ON (>1)?
410 D = RND(2)
420 IF D = 1 THEN GOSUB 710 ELSE GOSUB 810

500 REM ** IF NO KEY PRESSED, GOTO 210
510 IF INKEY$ = "" THEN 210

600 REM ** WAIT FOR KEY, GOTO 210
610 IF INKEY $ = "" THEN 610
620 GOTO 210

700REM ** TURN OFF 4 BLIPS SUBROUTINE
710 RESET(31 – H, 15 – V)
720 RESET(31 – H, 16 + V)
730 RESET(32 + H, 15 – V)
740 RESET(32 + H, 16 + V)
750 RETURN

800 REM ** TURN ON 4 BLIPS SUBROUTINE
810 SET(31 – H, 15 – V, KOLOR)
820 SET(31 – H, 16 + V, KOLOR)
830 SET(32 + H, 15 – V, KOLOR)
840 SET(32 + H, 16 + V, KOLOR)
850 RETURN
```

Also try:

```
410 D = RND(3)
420 IF D>1 THEN GOSUB 710 ELSE GOSUB 810
```

Then try:

```
410 D = RND(4) or 410 D = RND(5) or . . .
```

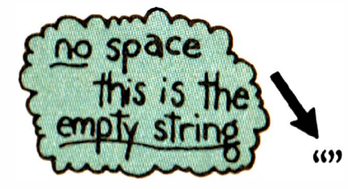
And while you are experimenting, try Variation 4 with the above Mandala program.

The Key to INKEY$

The **INKEY$** function scans the keyboard. If you press a key, the value of **INKEY$** is a *one character string.*

- If you press the [A] key, the value of **INKEY$** is "A".
- If you press the [Z] key, the value of **INKEY$** is "Z".
- If you press the space bar, the value of **INKEY$** is " ".
- If you *don't* press a key, the value of **INKEY$** is "".

Note the difference: " "



In Mandala, ever changing, we use **INKEY$** twice.

```
510 IF INKEY$ = "" THEN 210
```

Line 510 says: If the value of **INKEY$** is nothing, go to line 210. This happens if you don't press a key.

```
610 IF INKEY$ = "" THEN 610
620 GOTO 210
```

Line 610 causes the computer to keep scanning the keyboard until a key is pressed. When a key is pressed, the computer moves on to line 620 and, of course, goes to line 210.

Experiment! Try this short program, which uses **INKEY$**.

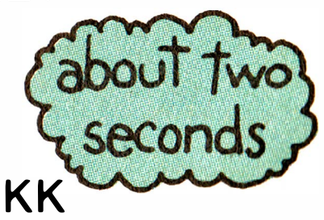
```
100 REM ** EXPERIMENT WITH INKEY$
110 CLS

200 REM ** TELL WHAT TO DO
210 PRINT: PRINT "PRESS A KEY"

300 REM ** TIME DELAY
310 TT = 920
320 FOR KK = 1 TO TT: NEXT KK

400 REM ** SCAN KEYBOARD, PRINT KEY
410 PRINT "YOU PRESSED", INKEY$

500 REM ** DO IT AGAIN
510 GOTO 210
```



Here is what happened when we ran the program.

```
PRESS A KEY
PRESS A KEY   A
PRESS A KEY
PRESS A KEY
PRESS A KEY   7
PRESS A KEY   %
```

←We didn't press a key.
←We pressed the [A] key.
←We didn't press a key.
No key here, either.
←We pressed [7].
←Quickly, [SHIFT], [%] [5]

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This timely, compact publication provides up to the minute information on pocket computers, including models such as the Radio Shack TRS-80 Pocket Computer, Sharp Electronics' PC-1211, the Casio FX-702P, Panasonic's RL-H1000, and others as they are announced. We only cover pocket computers that are capable of executing a high level language such as BASIC. We also report on attachments and software (programs) as they are made available for these devices.

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. . . and so on. Press a key!
Spend some time with this program.

•If you don't press a key, the computer prints **YOU PRESSED**, followed by empty space.

•If you press a key, the computer tells you what key you pressed. Well, as you will find out, some keys are "invisible."

Now try this: quickly press two or three keys. The computer will "see" only the last key you pressed, just a tiny instant before it executes line 410. If you have trouble seeing this, increase the time delay in line 310.

Have you figured out how to beat the Reaction Time Program in last month's "My Computer Likes Me"? (The program is reprinted below.) Here's how. When the computer prints **PRESS ANY KEY AND I'LL BEGIN**, you press the space bar *twice*. Or press any key, then press the space bar immediately, *before* the computer starts counting near the middle of the screen.

Last Month's Reaction Time Program

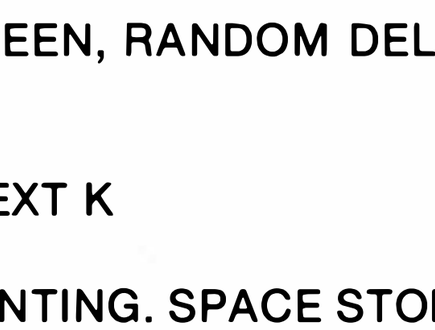
```
100 REM ** REACTION TIME PROGRAM

200 REM ** TELL HOW TO PLAY
210 CLS
220 PRINT "HOW FAST ARE YOU? WHEN I
    START"
230 PRINT "COUNTING, PRESS THE SPACE BAR"
240 PRINT "AS FAST AS YOU CAN TO STOP ME."
250 PRINT
260 PRINT "PRESS ANY KEY AND I'LL BEGIN."
270 IF INKEY$ = "" THEN 270

300 REM ** CLEAR SCREEN, RANDOM DELAY
310 CLS
320 Z = RND(2000)
330 FOR K = 1 TO Z: NEXT K

400 REM ** START COUNTING. SPACE STOPS IT.
410 X =1
420 PRINT @240,X
430 IF INKEY$ <> " " THEN X = X + 1: GOTO
    420

500 REM ** TELL HOW TO PLAY AGAIN
510 PRINT @0, "TO PLAY AGAIN, PRESS ANY
    KEY. "
520 IF INKEY$ = "" THEN 520 ELSE 210
```



You can fix it by adding the following line to the program.

```
340 X$ = INKEY$
```

This will clear out the value of **INKEY$** just before the computer begins counting in lines 410 through 430. Line 340 will be done so fast it is unlikely that you can press the space bar while the computer is going from line 340 to line 410.

More Stars Twinkling

Here's a program to put lots of stars on the screen, then make them twinkle.

```
100 REM ** MORE STARS TWINKLING
110 DIM OVER(100), DOWN(100), KOLOR(100)
120 CLS 0

200 REM ** RANDOM POSITION & KOLOR
210 FOR STAR = 1 TO 100
220     OVER(STAR) = RND(64) – 1
230     DOWN(STAR) = RND(32) – 1
240     KOLOR(STAR) = RND(8)
250 NEXT STAR

300 REM ** TURN ON THE STARS
310 FOR STAR = 1 TO 100
320     SET(OVER(STAR), DOWN(STAR),
        KOLOR(STAR))
330 NEXT STAR

400 REM ** PICK A RANDOM STAR
410 RS = RND(100)

500 REM ** TWINKLE IT
510 RESET(OVER(RS), DOWN (RS))
520 GOSUB 810
530 SET(OVER(RS), DOWN(RS), KOLOR(RS))
540 GOSUB 810

600 REM ** GO PICK ANOTHER STAR
610 GOTO 410

800 REM ** TIME DELAY SUBROUTINE
810 TT = 50
820 FOR KK = 1 TO TT: NEXT KK
830 RETURN
```

RUN this program. When you enter, be especially careful to type the correct number of parentheses in lines 320, 510, and 530.

This program puts 100 stars in random places on the screen, then twinkles one star at a time. Actually, there might be fewer than 100 stars on the screen because the same values of **OVER(STAR)** and **DOWN(STAR)** might happen more than once in block 200. We assume that you know about subscripted variables such as **OVER(STAR)**, **DOWN(STAR)**, and **KOLOR(STAR)**. If not, let us know and we'll contrive a short tutorial.

Try some variations.

LOGO

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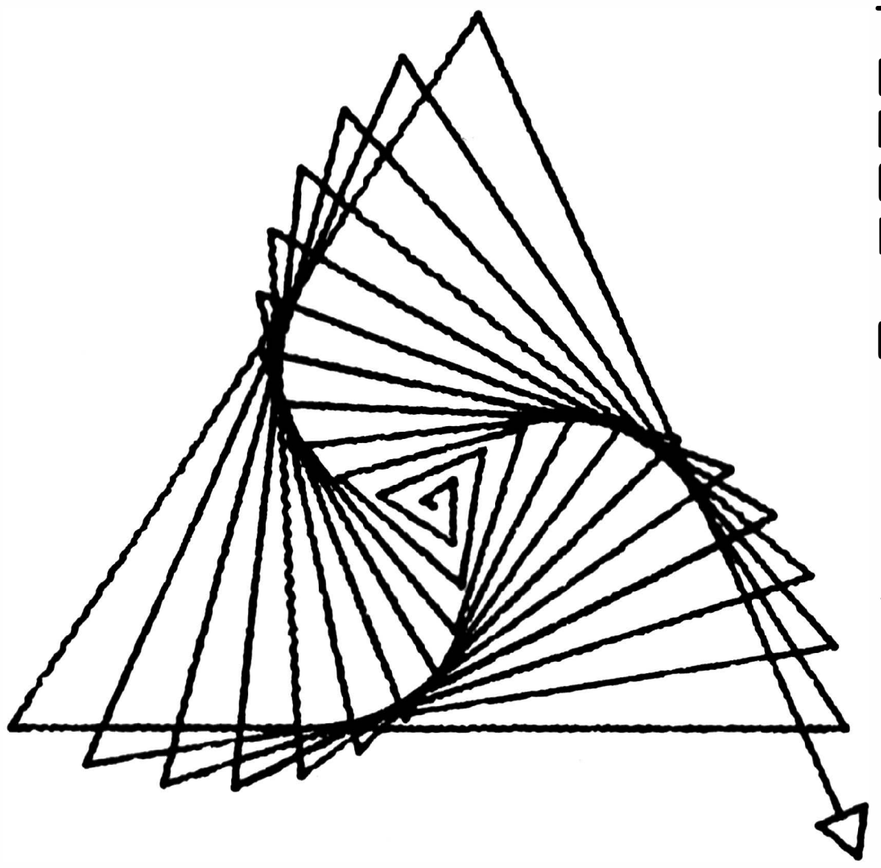

```
TO POLYSPI :SIDE :ANGLE :INC
FORWARD :SIDE
RIGHT :ANGLE
POLYSPI :SIDE+:INC :ANGLE :INC
END

POLYSPI 1 123 3
```

This drawing was made by this program using LOGO's "turtle graphics".

The turtle is a Logo-controlled "cybernetic toy" that draws lines as it moves across the TV screen. Directing the turtle to construct graphic designs, programmers simultaneously confront aesthetic and mathematical issues.

Logo is more than turtle graphics. Logo was designed to put some of the powerful ideas of computer science at your disposal— ideas like procedure, process, local and global variables, list processing, recursion, etc. Its syntax is simple enough that beginners can write procedures in a first session, yet Logo is extensible and provides the means to tackle advanced and sophisticated projects.

Logo has often been described as a language for children. It is so, but in the same sense that English is a language for children, a sense that does not preclude its being ALSO a language for poets, scientists, and philosophers.

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•Cosmic Concert. Replace block 800 with the following:

```
800 REM ** COSMIC CONCERT SUBROUTINE
810 TT = RND(176)
820 SOUND TT, 1
830 RETURN
```

Also, try a longer duration in line 820.

•Or make these changes to the original program. (Leave block 800 as it is in the original program.)

```
540 GOSUB 910

900 REM ** COSMIC CONCERT SUBROUTINE
910 TT = RND(176)
920 SOUND TT, 1
930 RETURN
```

•Instead of putting stars in random places, **READ** star positions and colors from **DATA** statements. Put a constellation on the screen and twinkle the stars.

Word's Worth

Assign a number score to each letter of the alphabet, A through Z, as follows:

A = 1	H = 8	O = 15	V = 22
B = 2	I = 9	P = 16	W = 23
C = 3	J = 10	Q = 17	X = 24
D = 4	K = 11	R = 18	Y = 25
E = 5	L = 12	S = 19	Z = 26
F = 6	M = 13	T = 20	
G = 7	N = 14	U = 21	

A word's worth is its numerical value, obtained by adding the values of the letters in the word. For example, **HOBBIT** is worth 56 points, **DRAGON** is worth 59 points, and **WIZARD** is worth 81 points.

Let's write a program to compute a Word's Worth. A **RUN** might go like this:

```
YOUR WORD? WIZARD
YOUR WORD IS WORTH 81
POINTS

YOUR WORD? ISN'T
YOUR WORD IS WORTH 62
POINTS                          Ignore apostrophe (')

YOUR WORD? FLIP-FLOP
YOU WORD IS WORTH 92
POINTS                          Ignore hyphen (-)

YOUR WORD? ABCD
YOUR WORD IS WORTH 10
POINTS

YOUR WORD? 3#AB%*Z
YOUR WORD IS WORTH 29
POINTS                          Ignore everything ex-
                                cept letters.

YOUR WORD?                      and so on . . .
```

Our program should compute the score, or worth, of any word or even any string of letters, even if it isn't a word.

Here is our first Word's Worth program.

```
110 REM ** WORD'S WORTH #1
110 CLS

200 REM ** ASK FOR A WORD
210 PRINT
220 INPUT "YOUR WORD"; WORD$

300 REM ** WL IS LENGTH OF WORD
310 WL = LEN(WORD$)

400 REM ** START WORD'S WORTH AT ZERO
410 WW = 0

500 REM ** COMPUTE WORD'S WORTH
510 FOR L=1 TO WL
520    L$ = MID$(WORD$, L, 1)
530    LV = ASC(L$) - 64
540    WW = WW + LV
550 NEXT L

600 REM ** PRINT THE WORD'S WORTH
610 PRINT "YOUR WORD IS WORTH" WW
    "POINTS"

700 REM ** GO DO IT AGAIN
710 GOTO 210
```

Try it. You'll see that it works OK for words such as **WIZARD** or **DRAGON** or **HOBBIT**, but doesn't work for **ISN'T** or **FLIP-FLOP** or **3#AB%*Z**. Never mind—we'll fix that next time. Better yet, can *you* fix it?

Next month, we will also explain how the program works and tell you more about **LEN** (line 310), **MID$** (line 520), **ASC** (line 530). In the meantime, use the program to do these:

Find a word whose Word's Worth is 100.

Find the shortest word whose Word's Worth is 100.

Find the longest word whose Word's Worth is 100.

For each prime number less than 100, find a word whose Word's Worth is equal to the prime number.

Find a word whose Word's Worth is equal to your age.

THIRTEEN is worth 99 points. Is there a number whose spelled-out name has a Word's Worth equal to the number?

ONE MILLION is worth 118 points, which is less than one million. Find the smallest whole number whose spelled-out name has a Word's Worth less than the number.

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AHA is worth 10 points. AHA is a palindrome (it reads the same left to right or right to left), but 10 is not a palindrome. Are there words that are palindromes whose Word's Worths are also palindromes?

(Oops, almost forgot. In the above, use only real dictionary words. If you send us answers, please tell us what dictionary you used.)

More Racing Colors

Here is an entirely different kind of color race. This time, flip a coin. If it is heads, advance green one space. If tails, advance red one space.

```
100 REM ** RACING COLORS #3
110 CLS 0

200 REM ** START RACE AT LEFT OF SCREEN
210 GX = 0: SET(GX, 16, 1)
220 RX = 0: SET(RX, 24, 4)

300 REM ** FLIP COIN H=1, T=2
310 COIN = RND(2)

400 REM ** ADVANCE GREEN OR RED
410 IF COIN=1 THEN GX=GX+1: SET(GX, 16, 1)
420 IF COIN=2 THEN RX=RX+1: SET(RX, 24, 4)

500 REM ** WINNER? IF NOT, RACE SOME MORE
510 IF GX=63 THEN 610
520 IF RX=63 THEN 710
530 GOTO 310

600 REM ** GREEN IS WINNER
610 PRINT @0, "THE WINNER IS . . . GREEN!"
620 PRINT "FOR ANOTHER RACE, PRESS ANY
    KEY"
630 IF INKEY$ = "" THEN 630 ELSE 110

700 REM ** RED IS WINNER
710 PRINT @0, "THE WINNER IS . . . RED!"
720 PRINT "FOR ANOTHER RACE, PRESS ANY
    KEY"
730 IF INKEY$ = "" THEN 730 ELSE 110
```

Now it's your turn. Instead of announcing the winner, blink the winning color, green or red, in its winning position (GX = 63 or RX = 63).

How could you change the program so that green has a better chance of winning than red? Or just the opposite?

It's still your turn. Write a program to race three colors—blue, red, and yellow (give green a rest).

Wandering Star

Wandering Star wanders about the universe looking for cosmic oasis that contain her favorite food, cosmic dust. When she finds a cosmic oasis, she wanders about it, eating any cosmic dust she finds. Oddly enough, a cosmic oasis looks just like a green TV screen when your Color Computer is hooked up to it. Cosmic dust sometimes looks like points (.) scattered about the screen (oops! cosmic oasis). Wandering Star first appears near the center of the oasis, then rests for a brief time, perhaps thinking hungrily about cosmic dust.

After her brief rest, Wandering Star wanders—right, left, up, down—looking for cosmic dust. If she meanders into a place that contains a cosmic dust mote, she eats it, then moves on.

Eventually, Wandering Star may reach the edge of the oasis and disappear. This usually happens long before she has eaten all the cosmic dust. When this happens, a mysterious message appears in the cosmic oasis: **FC ERROR IN 530.** What can it mean?

```
100 REM ** WANDERING STAR
110 CLS

200 REM ** COSMIC DUST
210 CD$ = "."
220 FOR K=1 TO 100
230     PRINT @RND(510), CD$;
240 NEXT K

300 REM ** WANDERING STAR APPEARS
```


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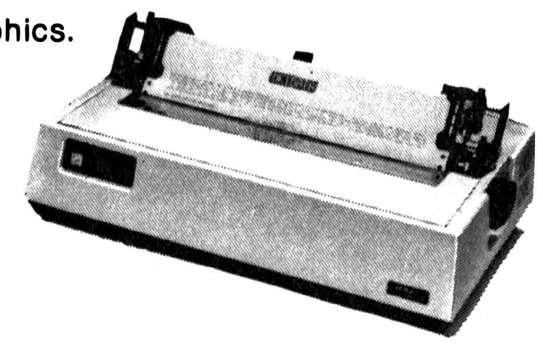

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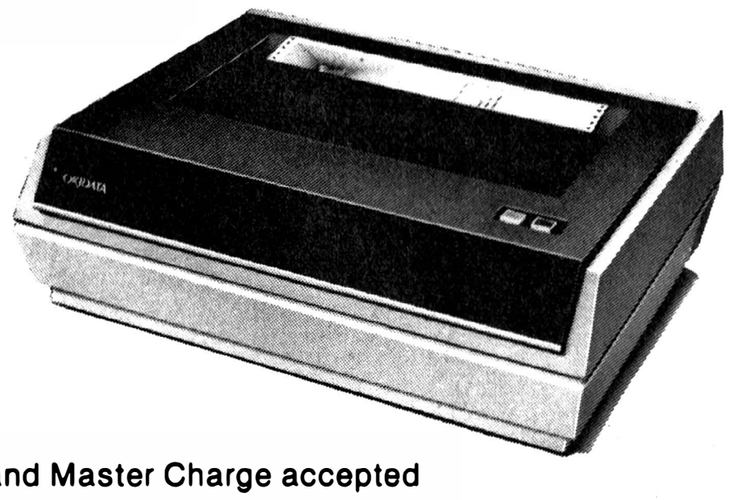

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```
310 WS$ = "*"
320 X = 240
330 PRINT @X, WS$;
340 TT = 1000: GOSUB 1010

400 REM ** RIGHT, LEFT, DOWN, OR UP?
410 W = RND(4)
420 IF W=1 THEN X2 = X + 1
430 IF W=2 THEN X2 = X - 1
440 IF W=3 THEN X = X + 32
450 IF W=4 THEN X2 = X - 32

500 REM ** WANDERING STAR WANDERS
510 PRINT @X, "  ";
520 X = X2
530 PRINT @X, WS$;
540 SOUND 176, 1
550 TT = 100
560 GOSUB 1010

600 REM ** GOTO DIRECTION SELECTOR
610 GOTO 410

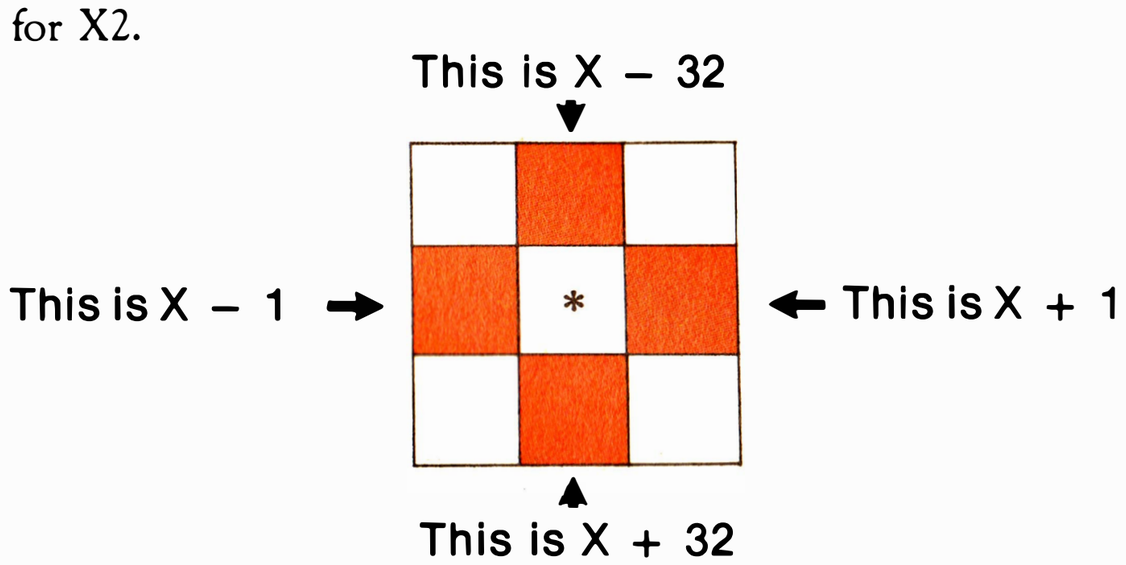
1010 FOR KK=1 TO TT: NEXT K
1020 RETURN
```

Enter the program and **RUN** it. Cosmic dust appears (block 200) on a green screen (line 110). The Wandering Star appears near the center of the screen and rests a short time (block 300). Wandering Star is represented by an asterisk (line 310).

```
310 WS$ = "*"
```

Wandering Star

Block 400 computes a new screen position (X2) for Wandering Star. The new position is chosen at random from four possibilities. The following diagram shows Wandering Star in position X and the four possible places for X2.



Remember: There are 512 print positions on the screen, numbered 0 to 511. They are arranged in 16 lines with 32 positions in each line.

Aha! That explains lines 440 and 450.

Line 440: Add 32 to X to move *down* one line.
LIne 450: Subtract 32 from X to move *up* one line.

And so we arrive at line 510. This erases Wandering Star from where she now is in screen position X. Then, in line 520, the value of X is replaced by her new position, X2. Line 530 prints her in the new position. We'll let you figure out why we didn't do it as follows:

```
510 PRINT @X, "  ";
530 PRINT @X2, WS$;
```

Trouble! If X is less than 0 or more than 511, the computer will stop with an **FC ERROR in 530**. Here is one way to fix that—we'll try other ways later. Add the following lines to the program:

```
460 IF X2<0 OR X2> 510 THEN 710
700 REM ** WANDERING STAR DISAPPEARS
710 PRINT @X, "  ";
720 PRINT @0, "FAREWELL, WANDERING STAR"
```

Now, if Wandering Star wanders out into the cosmic desert, we'll simply bid her farewell. You may wonder why we used 510 instead of 511 in line 460 and also in line 230. Printing in print position 511 causes the entire screen to

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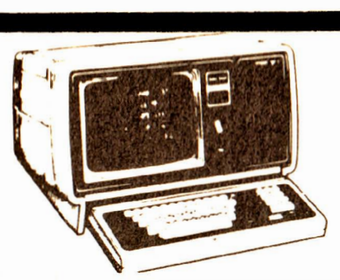
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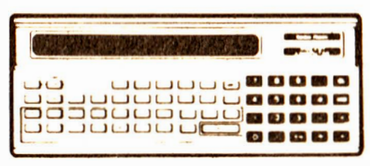
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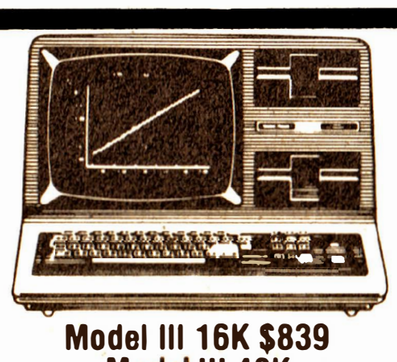
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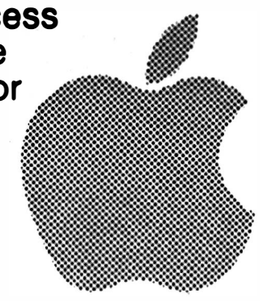

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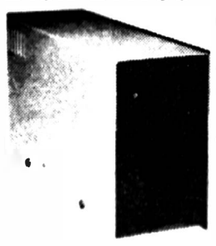

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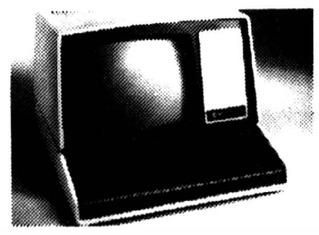

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My Computer Likes Me

scroll up one line. We don't want that to happen, so we avoid position 511.

Try any or all of these variations:

```
310 WS$ = CHR$(191)
210 CD$ = ","          Long-tailed dust motes
210 CD$ = "@"          Cosmic escargot
```

Well, Wandering Star wanders and eventually leaves the screen. Farewell, Wandering Star. Alas, the part of the universe surrounding the screen is a cosmic desert. The screen, of course, is a cosmic oasis. So, after wandering in the desert for a while, Wandering Star decides to return to the oasis where she can again savor cosmic dust and think about other oases elsewhere in the universe (and therein lies another story).

Think about how Wandering Star might return. She left the universe along one of the edges of the screen . . . hmm, perhaps she could reappear somewhere at the edge of the screen. Does she learn from experience? Will she soon disappear again into the desert? Or will she remain eating in the oasis, pondering the greater universe, then invent or discover a way to move beyond the cosmic desert into other (and different) oases?

This reminds us of the ancient tale about the inquisitive Russian ruler who watched the night sky, attempting to understand the inexplicable movements of an unpredictable heavenly body. Yes, Wondering Tsar saw Wandering Star.

Help!

What would you like to see in "My Computer Likes Me"? Send requests to George and Ramon, POB 310, Menlo Park, CA 94024. If you want a reply, enclose a self-addressed, stamped envelope.

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DragonSmoke
Rainbows and Mail Play

"DragonSmoke" is a monthly column for people helping kids program and enjoy computers. We point to resources and sources of inspiration we've found useful, helpful, and entertaining in our use of the Atari 400 and 800, Commodore PET and VIC-20, Radio Shack TRS-80 Model I, Model III, and Color Computer, and Texas Instruments TI 99/4A.

"DragonSmoke" is subjective and highly opinionated. It's based on 20 years of personal experience helping thousands of kids learn to program and have fun with computers. We also point to sources of information about role-playing games such as Dungeons and Dragons, Runequest, and Tunnels and Trolls. Opportunity knocks—new ways to learn beckon.

Continued on page 94

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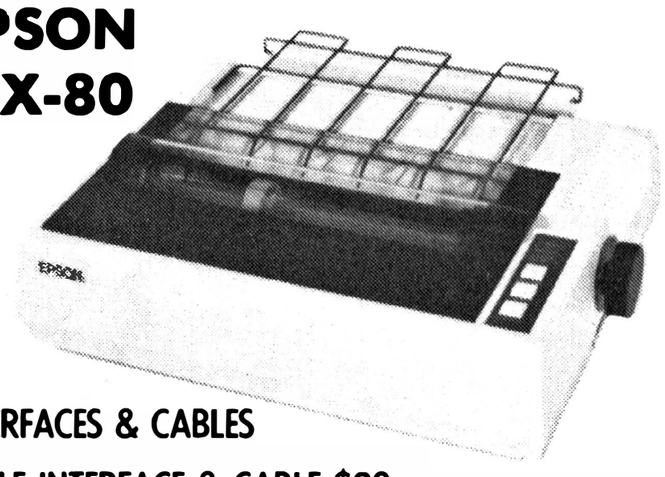

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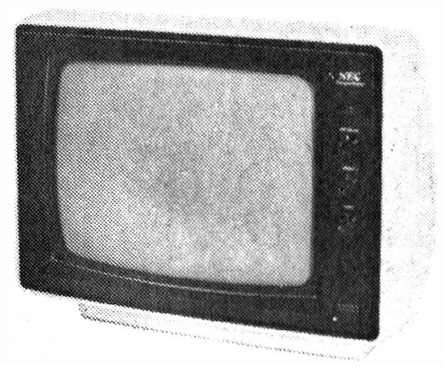

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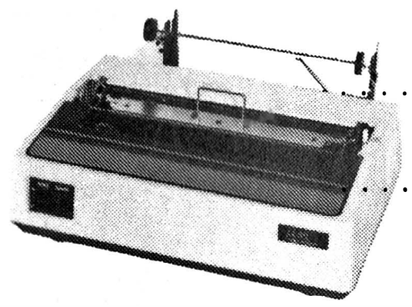

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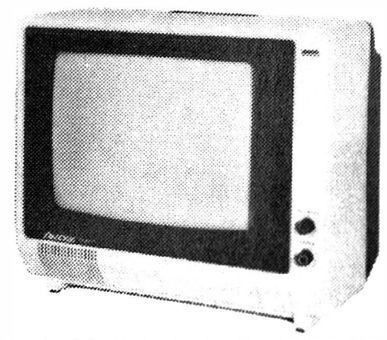

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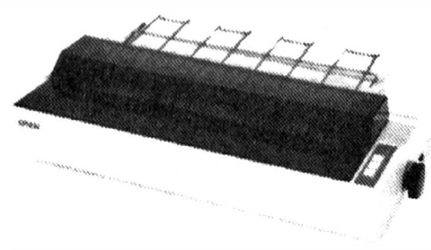

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The Rainbow Machines

When I think about low-cost ($300 to $800) computers for recreation and education, at home or at school, I think of the Atari 400, the Commodore VIC-20, the Radio Shack Color Computer, and the Texas Instruments TI 99/4A.

If you own a Rainbow Machine, look to these sources of information and inspiration.

●*Home and Educational Computing*, POB 5406, Greensboro, NC 27403. $10/year (6 issues).

Originally aimed at the Commodore VIC-20, this magazine has expanded to include all of the Rainbow Machines. A top priority for Rainbow Machine aficionados.

●*Color Computer News*, POB 1192, Muskegon, MI 49443. $9/year (6 issues).

In my 20 years of working (playing!) with kids and computers, the Radio Shack Color Computer is the best computer I have used to help beginners to learn to use, program, and enjoy BASIC. *CCN* is devoted entirely to the Color Computer, Radio Shack's Rainbow Machine. Highly recommended.

●*Chromosette*, POB 1087, Santa Barbara, CA 93102. Monthly, $25 for 6 issues or $45 for 12 issues. Single issues $5.

Chromosette is a cassette magazine. Each month you receive a cassette with a number of programs for your 16K (or more) Color Computer with Extended Color BASIC. The best software bargain I know of for Radio Shack's Rainbow Machine.

●*IRIDIS*, POB 550, Goleta, CA 93116. *IRIDIS #1* for $9.95, *IRIDIS #2* for $15.95 (cassettes; add $3 for disk).

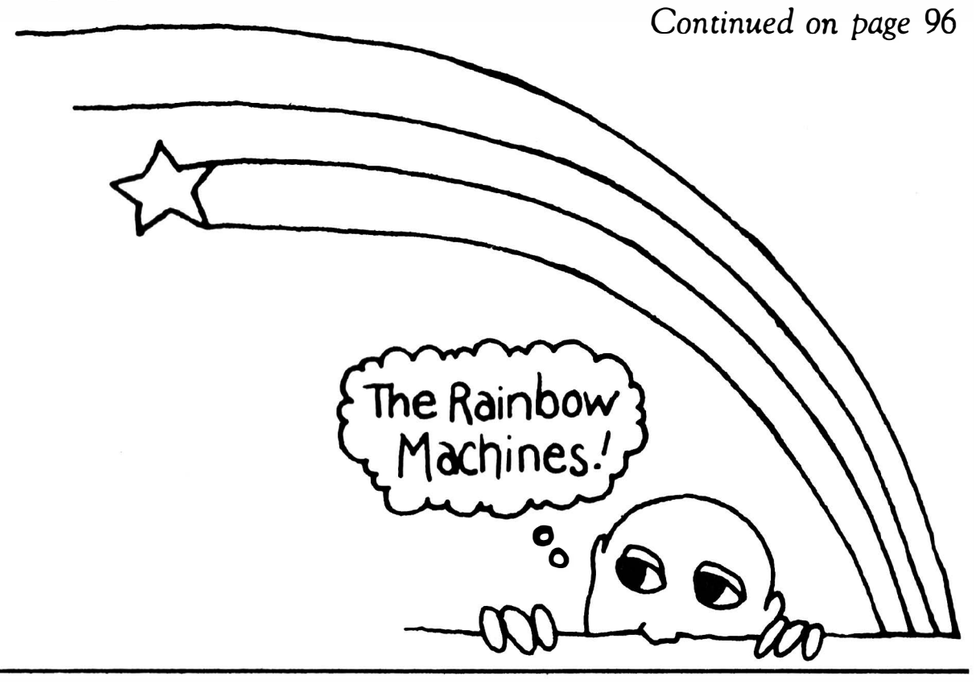
A tutorial series for the Atari 400 and 800. Each *IRIDIS* consists of a cassette with programs plus a booklet containing program listings, detailed explanations on how the programs work, and advice on programming for novices and intermediates.

●*Vixel*, POB 550, Goleta, CA 93116. $12.95 each.

This is a series of cassettes for the Commodore VIC-20 by the people who publish *Cursor* and *IRIDIS*. We haven't seen *Vixel* yet, but expect it to be of the same high quality as *Cursor* and *IRIDIS*.

Next month we'll have more Rainbow Machine stuff, featuring the languages of the future: Atari PILOT and TI LOGO.

Continued on page 96



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Play By Mail (PBM)

One of the easiest ways to start playing fantasy or science fiction role-playing games is to play by mail. Begin by acquiring a set of rules. Then sign up for a computer-refereed game. The computer (or person) who referees the game sends you a beginning scenario. You respond with a "turn." That is, you tell the referee what you want to do within the rules of the game. This goes on until you are eliminated from the game or become a winner.

Start with:

●*Nuclear Destruction.* A strategic missile game with emphasis on diplomacy. To get the rules, send $0.50 to Flying Buffalo, POB 1467, Scottsdale, AZ 85252.

●*StarWeb.* A space game of strategy, diplomacy, economics—and a little luck! StarWeb is a game of 15 stellar empires clashing over 225 worlds. You can be an empire builder, apostle, pirate, merchant, berserker, or artifact collector. For the rules, send $2 to Flying Buffalo, POB 1467, Scottsdale AZ 85252.

●*Treacherous Trajan's Trap.* A Tunnels and Trolls dungeon exploration. Each turn you are given a description of what happened last move and a set of multiple-choice decisions for your next move. From Flying Buffalo, POB 1467, Scottsdale, AZ 85252. $5 setup charge plus $11 for the first five turns.

●*UNIVERSE III.* A computer-moderated correspondence game in which each player commands a starship entering a universe to explore, colonize, and conquer new worlds. Entry fee is $7, which covers a setup turn for one ship, a rule book, and an extra turn. Central Texas Computing, Suite 100, 1210 Nueces, Austin, TX 78701.

Beware! These games are addicting and you pay for each turn. Again beware—if you survive a few turns, you may run up your phone bill with long-distance calls to other players, creating alliances, negotiating with "enemies," or just indulging in cosmic conversation.

One more note: If you play StarWeb, or if you are thinking about playing StarWeb, read *Octagon*, by Fred Saberhagen, Ace Science Fiction, POB 400, Kirkwood, NY 13795. $2.75 plus $0.75 postage and handling. □

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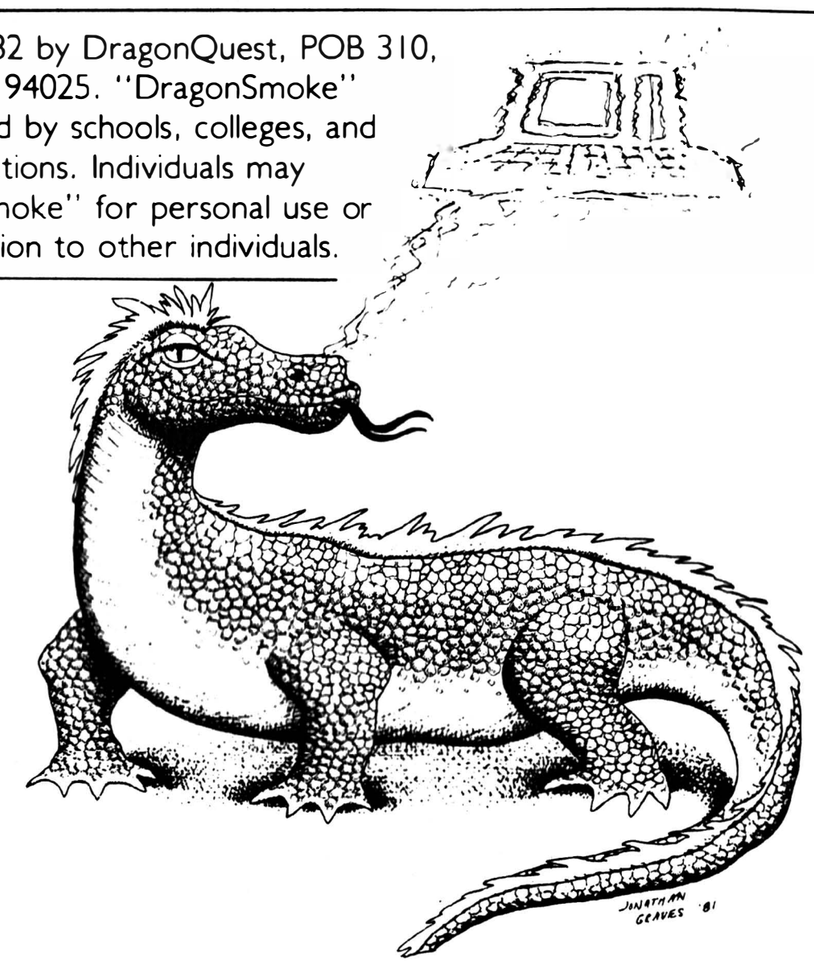

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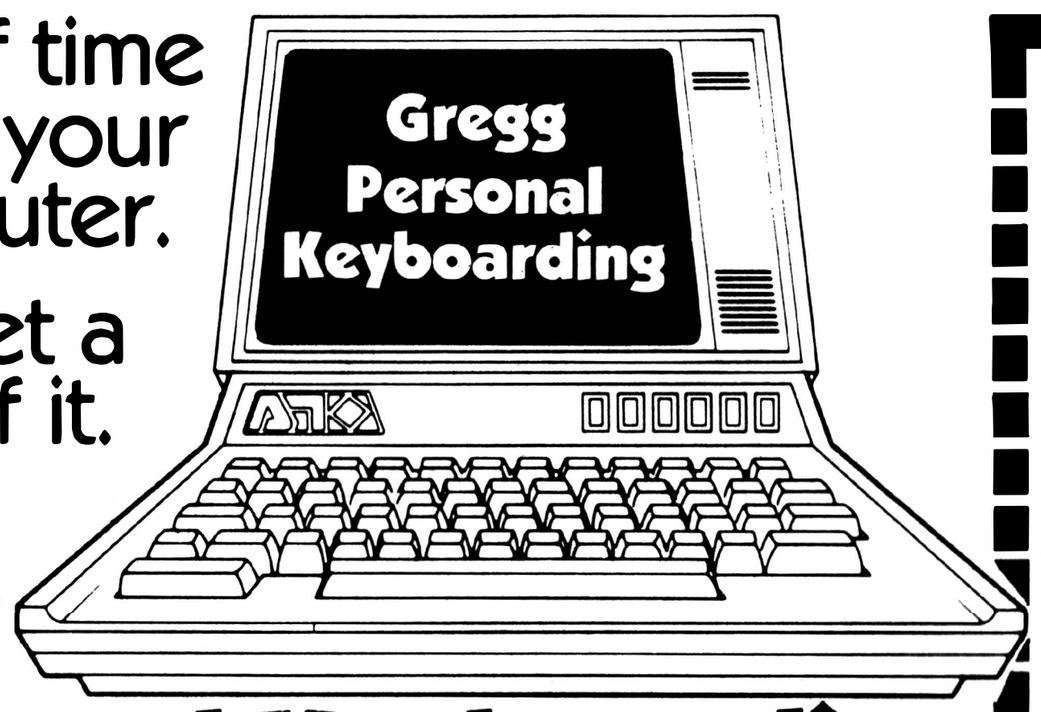

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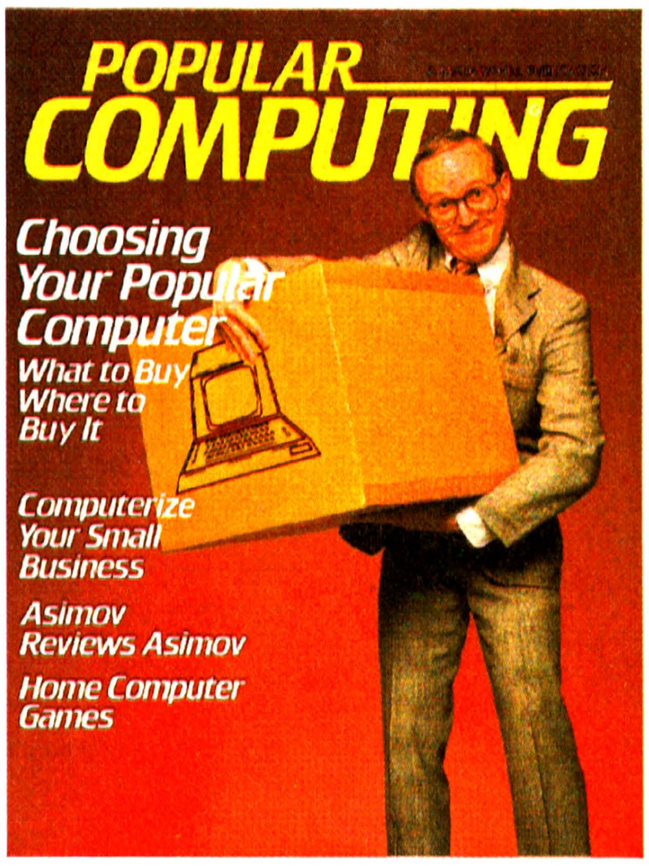

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Self-Teaching BASIC for the Apple

by Robert Schilling

If you plan to use your microcomputer as a teaching device, it seems reasonable that for its first task it should teach you how to operate and program it. And if an instructional program is worth using, it must be more interesting and effective than those already available free in your computer's manual.

Several companies now offer such instructional programs for the Apple II computer owner. Most of these programs use Integer BASIC, Apple's original version of BASIC. They take advantage of Integer BASIC's ability to check each instruction line as it's entered. This helps the novice programmer reduce the number of errors, which prevent a program from working properly.

Programming in Apple Integer BASIC: Self-Teaching Software is Hayden Book Company's contribution to this body of software.

What You'll Need

Hayden's package requires an Apple II and the following:

For an Apple with disk drive:

- Integer BASIC language (or Integer BASIC ROM [read-only memory] board)
- one disk drive
- Apple's disk operating system (DOS) 3.2.1 or 3.3
- 24K bytes or more of memory
- a color TV or monitor (preferred but not required)

For an Apple with cassette:

- Integer BASIC language (or Integer BASIC ROM board)
- a cassette recorder
- either 16K or 24K bytes of memory (depending on whether you believe the front cover or the first page of the manual)
- a color TV or monitor

If you have an Apple with the Language System or with one of the new 16K memory cards that load Integer BASIC from disk, you'll have to go through a cumbersome procedure (*one time only*) to make the Integer BASIC program run on your computer. (See the text box, "Apples with Language Systems.")

(If you're not sure if your Apple has Integer BASIC, you're not alone. The name problem has plagued new Apple owners for the last few years. The name of an Apple computer is derived from the particular version of BASIC that was included in ROM on the computer's main circuit board. After seeing the six designations [Apple II, Apple II Plus, Apple with Integer BASIC, Apple with Applesoft BASIC, Apple with Floating Point BASIC, and Apple III] you might think there are six kinds of Apples, but in fact, there are only three different Apple computers on the market. Apple II and Apple with Integer BASIC are the same; Apple II Plus, Apple with Applesoft BASIC, and Apple with Floating Point BASIC are all identical; and Apple III is the third model.)

How It Works

The first thing you'll notice about Hayden's *Programming* package is its documentation, or lack of it. The ten-page manual tells you how to get the program into the computer, how to

At a Glance

Name: Programming in Apple Integer BASIC: Self-Teaching Software

Type
Instructional software

Manufacturer
Hayden Book Company,
50 Essex St.,
Rochelle Park, NJ 07662

Price
$39.95

Format
Cassette or disk drive

Language
Integer BASIC

Computer
Apple II, Apple II Plus

Documentation
10-page booklet

control it, and what's covered in each lesson. It also contains four brief program listings. Since lesson 1 of the software repeats the operating instructions, you can do without the manual entirely if you already know how to run a tape or disk on your system.

The disk version can be run on either of Apple's recent disk operating systems (DOS 3.2.1 or DOS 3.3), so starting the program only requires putting the disk in the drive and turning on the power. The tape version is less convenient because lessons are stored in sequence (three per side) and, unless you have a cassette with a counter, you may

Part of a session using Programming in Apple Integer BASIC.

```
    THIS IS A SHORT PROGRAM


                  : : :     HERE IS AN ACTUAL PROGRAM THAT WILL
DISPLAY SUCH A MESSAGE:

   10 PRINT "THIS IS A SHORT PROGRAM"
   20 END
                  : : :     10 PRINT "THIS IS A SHORT PROGRAM"
   20 END

1) NOTE THAT EACH OF THE ABOVE PROGRAM STATEMENTS BEGINS WITH AN
   INTEGER. THIS IS REFERRED TO AS THE 'LINE NUMBER' OF THE STATE-
   MENT.

2) THE LAST LINE IS AN 'END' STATEMENT. THIS TELLS THE APPLE THAT
   NOTHING FOLLOWS.

3) NOTE THE DIFFERENCE BETWEEN THE NUMERAL '0' AND THE LETTER 'O'.
   THEY ARE NOT INTERCHANGEABLE.

4) QUOTES MUST ENCLOSE THE MESSAGE TO BE PRINTED.
                  : :   :ONE OF THESE STATEMENTS IS INCORRECT:

1) 30 PRINT "I LIKE BASIC"

2) 20 PRINT "APPLE IS MY THING

3) 20 END

YOUR CHOICE? 2

FINE. THIS STATEMENT WON'T WORK.

THE CLOSING QUOTE IS MISSING.

   AS IT STANDS, THE STATEMENT WILL CAUSE A 'SYNTAX ERR' MESSAGE.
                  : :   :BUILDING A PROGRAM

   WHEN YOU FIRST START UP BASIC THERE IS NO PROGRAM IN THE APPLE.

A PROGRAM GROWS AS YOU TYPE STATEMENTS.

LET'S BUILD A SIMPLE PROGRAM.
                  : :   :THERE IS NO PROGRAM IN THE MACHINE.

TO ENTER OUR FIRST STATEMENT, WE TYPE:

   10 PRINT "THIS IS EASY"
                  : : :     10 PRINT "THIS IS EASY"
NOW THE COMPUTER HAS A ONE LINE PROGRAM.
OF COURSE, THIS PROGRAM IS NOT COMPLETE.
   WE MUST HAVE AN 'END' STATEMENT, SO WE TYPE IN THIS:

   20 END
                  : : :     20 END
NOW WE HAVE A TWO LINE PROGRAM.
                  : : :
WE CAN ADD A NEW STATEMENT BY ENTERING:

   15 PRINT "AND FUN TWO."
                  : : :     15 PRINT "AND FUN TWO."
```


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have to load two earlier lessons to reach the one you want.

With the disk version, you can select any lesson from a "menu." As a nice touch, either the number 1 or the word "one" will bring you to lesson 1. While not every method for protecting you from accidents was used (there's no protection against accidentally pressing <RESET>), the program definitely qualifies as user-friendly.

However (and the however became HOWEVER! before I had finished three lessons), the package includes one annoying feature. In every lesson at every pause when you press the space bar or enter an answer, the program starts a timer. Every 60 seconds this timer buzzes the speaker and displays "Are you there?" on the screen. It was cute at first, but less so as time went by. When the buzzer started going off during an analysis of a sorting routine, I was so aggravated that I disconnected the speaker. This feature is not optional and is very distracting.

But let's talk about the positive side of the instructional package. The twelve lessons teach you some common commands in BASIC and demonstrate at least one application where each is used. The lessons introduce the concept of programming style and call your attention to the need to write programs for people who are not computer programmers. The programs also use text windows, a technique where instructions are kept stationary on one part of the screen while other text is scrolled by elsewhere on the same screen. This simulates the way an actual program looks while it's being run.

On the negative side, in addition to that irritating buzzer, there is a lack of hands-on participation. Although the manual suggests that you "experiment . . . check some things out . . . write your own programs . . . have fun," the lessons are little better than a book shown on a monitor screen. The four short listings and lesson 12, which demonstrates the writing of a calendar program, aren't substitutes for interactive keyboard experience. Besides, some topics are given only superficial treatment. Low-resolution graphics are introduced and several very impressive animations are shown, but the lesson discusses little more than the placement of colored squares and lines on the screen.

The *Programming* package is useful for new microcomputer owners who have purchased machines to use with "canned" or prewritten software. For this group, extensive programming information is unnecessary and often intimidating. The approach used in *Programming* will dispel their notions of a "mysterious black box," provide a reasonable understanding of what is happening within the computer, and not demand the effort and practice that a thorough knowledge of programming requires. □

Robert Schilling is a freelance writer living in Amherst, Massachusetts, who specializes in reviewing educational software.

Apples with Language Systems

If you have an Apple II Plus (if you see a little character like this "]" on the screen when the computer is ready to program), DOS 3.3, and the Apple Language System or some similar 16K-byte memory board, you can't run Programming in Apple Integer BASIC *without following the steps listed below:*

1. *Start your system with the DOS 3.3 Master Disk in the drive to load the HELLO program.*
2. *Remove the Master Disk and replace it with a blank disk. If the disk isn't blank, the next step will erase anything on it.*
3. *With the blank disk in the drive, type INIT STARTUP.*
4. *The drive will whir and clack for a minute. Don't panic. That's just what it's supposed to do.*
5. *When the red light on the drive stops, remove the disk you've just "initialized" and put the System Master back in the drive.*
6. *Type BRUN FID. When the menu appears on the screen, choose option one, Copy Files.*
7. *After answering questions about the drives to be used according to the number you have, copy the file named INTBASIC from your Master Disk to your new initialized disk.*
8. *You should now have a new disk with two files in storage: STARTUP and INTBASIC.*
9. *You now have a disk that will load Integer BASIC into your Language (16 K RAM) card.*
10. *Put your Master Disk back into the drive and type BRUN MUFFIN. When the menu appears, select 1, Copy Files.*
11. *Again answer the questions about drives according to the number you have, but when asked for the name of the file you want to copy, answer with the = (equal sign). Known as the "wild-card character," this tells the computer to copy all files on the disk you are using.*
12. *Finally, copy all files from the first of the two* Programming *disks to your new disk.*
13. *Repeat the process for the second* Programming *disk.*

An explanation is in order. You've just made a DOS 3.3 copy of Programming *on a two-program disk that will put Integer BASIC into your Language Card. This is necessary because* Programming *is written in Integer BASIC, but doesn't have the ability to load Integer BASIC to your card. If you try to run it without this modification, your Apple will keep flashing LANGUAGE NOT AVAILABLE!*

There's one last step. When you run your new disks, they will load Integer BASIC and stop. You must then type RUN HELLO to start running Programming.

The adventurous among you can take this one step further and make Programming *start automatically:*

1. *With your new disk in the drive, type LOAD STARTUP.*
2. *Type LIST 240. The computer should print back:*
   ] 240 END.
3. *Type 240 D$=CHR$(4) : PRINT D$; "RUN HELLO".*
4. *Type SAVE STARTUP.*

Congratulations. If you place your disk in the drive and turn on the power, it should run Programming *automatically. Do the same to the second disk to make it run automatically, too. Incidentally, the first part of this process, up to step 8, is all that is required to make any disk load Integer BASIC to a Language Card.*

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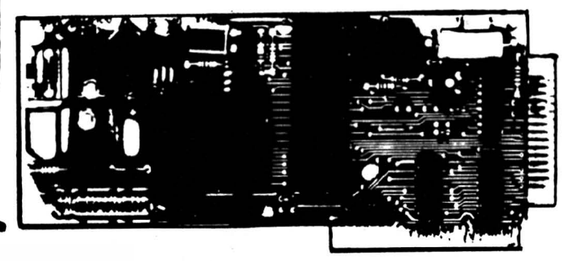

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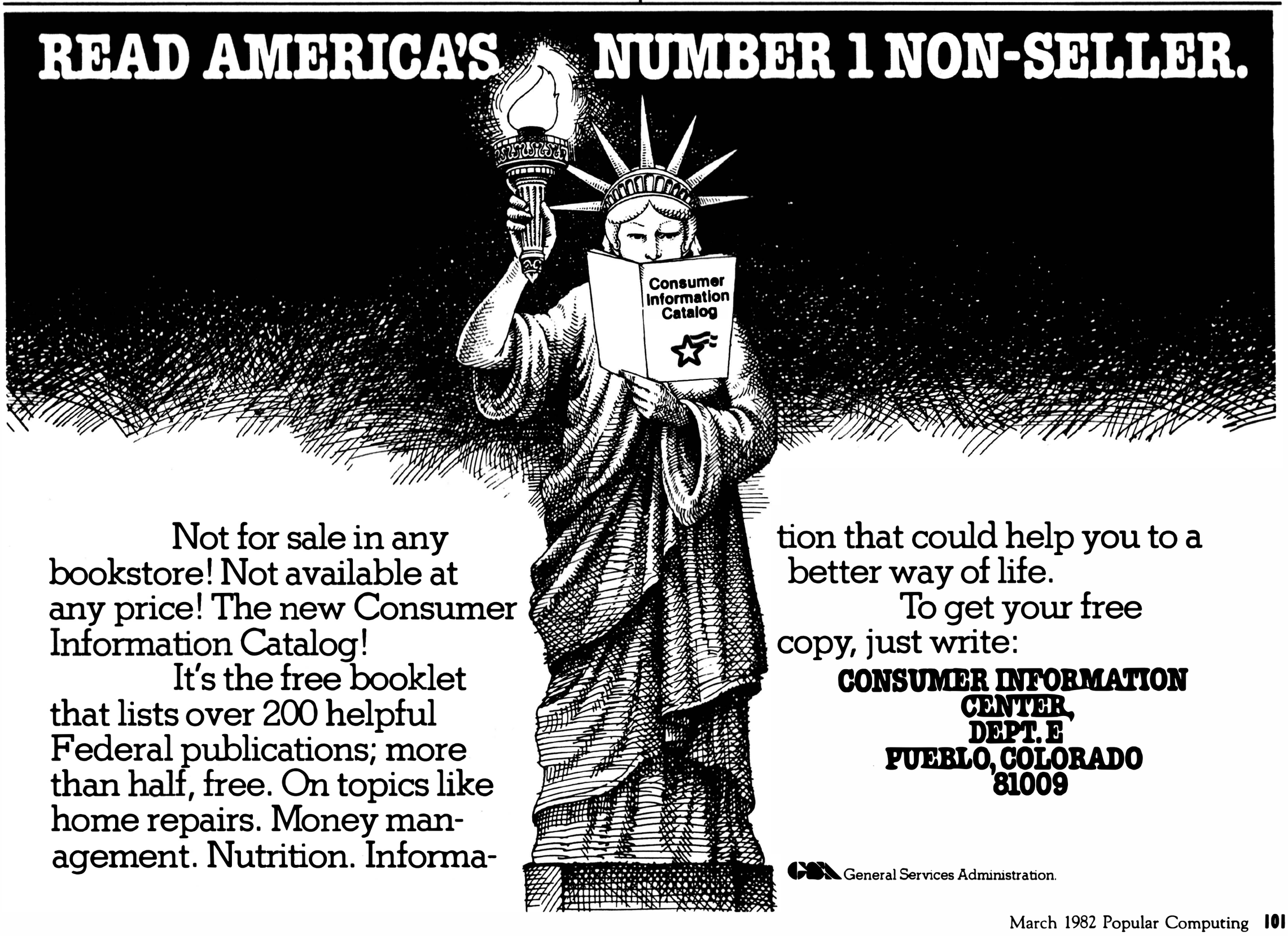

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SILICON VALLEY

THE WILD WEST OF COMPUTER TECHNOLOGY

by A. Richard Immel

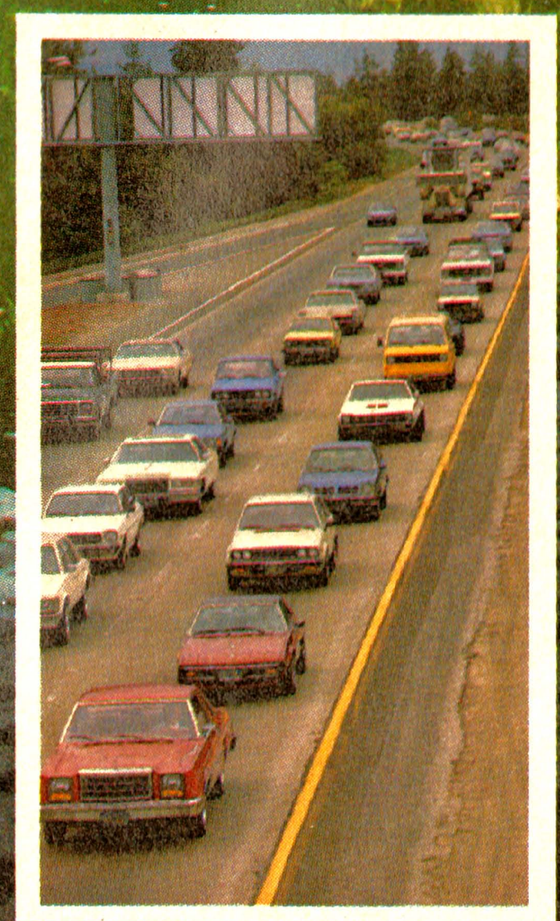
It's Friday noon at the south end of San Francisco Bay and the weather is what you expect California weather to be: warm, sunny, thoroughly gorgeous. "Come on, I'll show you the campus," the young man says. The grounds are lovely, with acres of grassy lawns broken by six single-story, ground-hugging buildings and a meandering, pebble-lined creek filled with golden carp. The $1.5-million recreation center has a full cast of noon-timers taking their licks on a smorgasbord of facilities: a weight room, saunas, and a fancy gym where a basketball game is in full, sweaty tilt. The Jacuzzi is bustling and so is the indoor/outdoor pool, where lap swimmers are working out.

If the Valley had a motto, it would have to be "Free Enterprise Over All."

Outside, there are tennis, horseshoes, volleyball, and a jogging course where the president sometimes shows up to run with the crowd. On the way to the stylish, subsidized cafeteria where you can eat your fill for a couple of dollars, we pass an open plaza used for beer parties and special gatherings.

All in all, it seems like a nice little college except for one thing: it's not a college, it's a *factory*. We've just had a tour of Rolm Corporation, Santa Clara, the nation's second-largest manufacturer of computerized telephone equipment and one of the fastest-growing companies in the hottest business community in the world: California's Silicon Valley.

Make that the *fabled* Silicon Valley where workers toil on "campuses," top executives jog with the troops, and companies throw beer parties to keep their employees happy—a place awash in high technology, fast money, and a curious blend of California lifestyle and Puritan work ethic.



The lush landscape of the Hewlett-Packard complex in Palo Alto contrasts sharply with the bumper-to-bumper traffic on Interstate 280.

There are more electronics companies in Silicon Valley than in any other place in the world.

The Valley of the Heart's Delight

Back in 1898 the area was dubbed the "Valley of the Heart's Delight" at the Fruit Tree Blossom Festival in nearby Saratoga. Nowadays, the once boundless orange, pear, and prune orchards have been uprooted in favor of freeways, tract homes, shopping centers, and industrial parks. The electronic connection has given the Valley a number of nicknames: "Silicon Gulch," "The Vale of Chips," and "The Fertile Crescent of Electronics" are a few. It's even called, incorrectly, Silicone Valley (silicone is a plastic derivative of silicon, the sand-like raw material used for making the crystal "wafers" on which microscopic electronic circuits are etched).

Silicon Valley statistics are staggering by any measure. There are more electronics companies here than any other place in the world, and venture capitalists prowl the valley creating more. Wealth flows from stock options and finds expression in expensive cars and private airplanes. No one knows anymore how many millionaires there are, although *Fortune* once put the number at 400. Of course, that was four years ago, in 1978—ancient history in the hyperworld of high technology. Apple Computer alone claims to have 40 paper millionaires on its payroll, the result of generous stock options and bountiful stock splits—and Apple didn't make its first public stock offering until 1980.

Silicon Valley is as much a state of mind as it is a place—a symbol of American know-how and technological innovation.

More than 1000 electronics firms generate $40 billion in annual sales, making the Valley the ninth-largest manufacturing center in the U.S. The same companies create 40,000 new jobs a year—20 percent of all high-technology jobs in the U.S. Only one out of five new firms goes belly up in the first five years: the national average is closer to four out of five.

Economists call the Valley "the engine that drives the Bay Area." According to the Center for Continuing Study of the California Economy, one-fifth of the new jobs in the entire Golden Bear State over the next ten years will originate in the Bay Area—most from expanding firms in Silicon Valley. Coldwell Banker, the nation's largest real-estate firm, credits

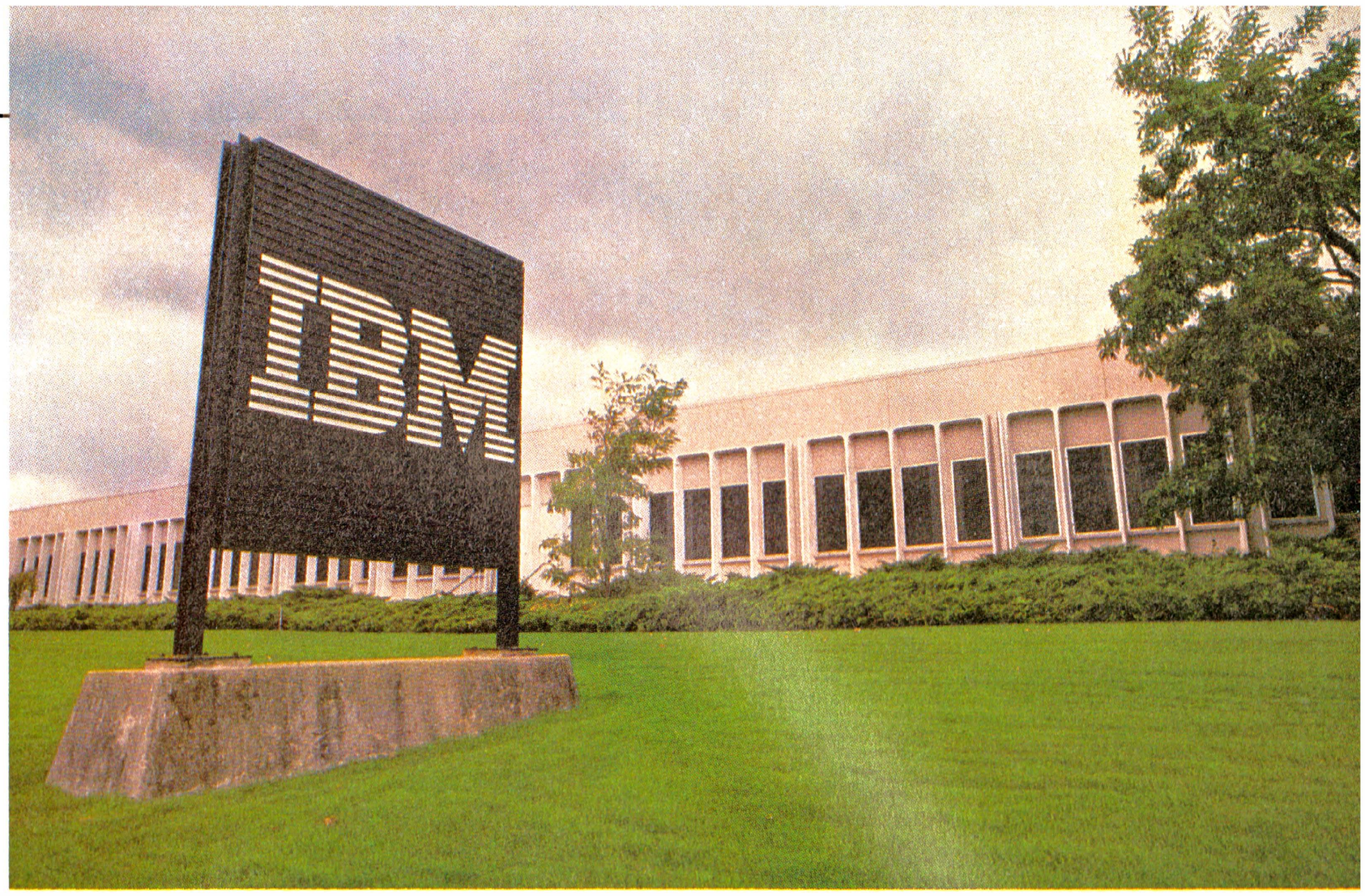
three-quarters of its commercial and industrial business in the south Bay Area to the electronics industry. "Electronics is the heart and soul of the peninsula," says one Coldwell Banker executive. "It's everything to us."

Snakes in the Garden

None of this ensures that paradise is perfect. Indeed, the Valley of the Heart's Delight is becoming known as the Valley of Paradoxes. The cars, the money, the thrill of the technological chase are, in many respects, a veneer. Where hard work is a virtue and success a necessity, the pressure to achieve takes its toll on family life. Twelve- and fifteen-hour workdays are common; spouses bring food to the office so families can eat together, and executives are afraid to take long vacations because it will keep them out of the "mainstream" too long. The divorce rate is high. "It's an extremely competitive environment in every respect—business, social, what have you," says one long-time executive. "There are intense work pressures, long hours, and a lot of travel. There's a lot of party giving and going. It's like the Wild West of American technology."

The Valley has its share of problems with drugs, both on and off the job, and there's a small but persistent black-market trade in certain hard-to-get electronic parts and stolen scrap gold (gold is used to make electrical contacts). Even the physical setting is deceptive; the south end of the San Francisco Bay has the worst smog in the area and air quality is worsening as freeways and city streets are increasingly clogged with commuter traffic. With your average three-bedroom "starter" house approaching $150,000, housing within a half-hour drive is virtually unaffordable, even for the highly paid, newly graduated engineers that are in such demand in the Valley. One community, Sunnyvale, took a drastic step last year by imposing a four-month moratorium on all industrial expansion just to give itself some breathing room.

A. Richard Immel, formerly with the San Francisco bureau of the Wall Street Journal, *is now a freelance writer and professional winemaker in Morgana, California.*



Another area of concern is the widening gap between the haves and the have-nots. A San Jose study group forecasts that Santa Clara county will be the fourth most affluent metropolitan area in the U.S. by 1983, but at the same time the number of families whose incomes fall below the poverty level is increasing.

Economists say more wealth has been created in the Valley in the last ten years than in any other place in America at any other time in the past. But even the money—or the way it's conspicuously displayed—has its critics. "Silicon Valley Tacky" is the way a transplanted Easterner describes Valley wealth. "They're nice people, but they seem a little more common than what you usually associate with great wealth," he says. "Millionaires by accident" is how they're described, "streetwise types" who are essential in the tough, competitive, semiconductor business, but who have little sensitivity or interest in cultural activities. "These are people who can have anything they want but they don't know what to get," this critic concludes. The result is an incongruous mix of flashy cars, polyester suits, and palatial homes decorated with plastic flowers.

Still, the Valley has a reputation as a land of legends, most of them true. It's a place where multimillion-dollar companies spring overnight from garages and kitchens on little more than a good idea, a shoestring, and a handshake. It's a fast-paced freeway where the American Dream is not only alive and well but proven every day. Read the papers—you'll find 11-year-olds running their own software companies, 21-year-old millionaires, and 31-year-old *retired* millionaires. It's the birthplace of the integrated circuit and the microprocessor—the computer-on-a-chip the size of a pinkie fingernail that revolutionized the electronics industry.

Local Color

If the Valley had a motto, it would be "Free Enterprise Over All." Scratch an electronics executive, an engineer, or a salesman, and you'll find a capitalist—

At Apple Computer Inc. secretaries are called area assistants and word processors have replaced typewriters.

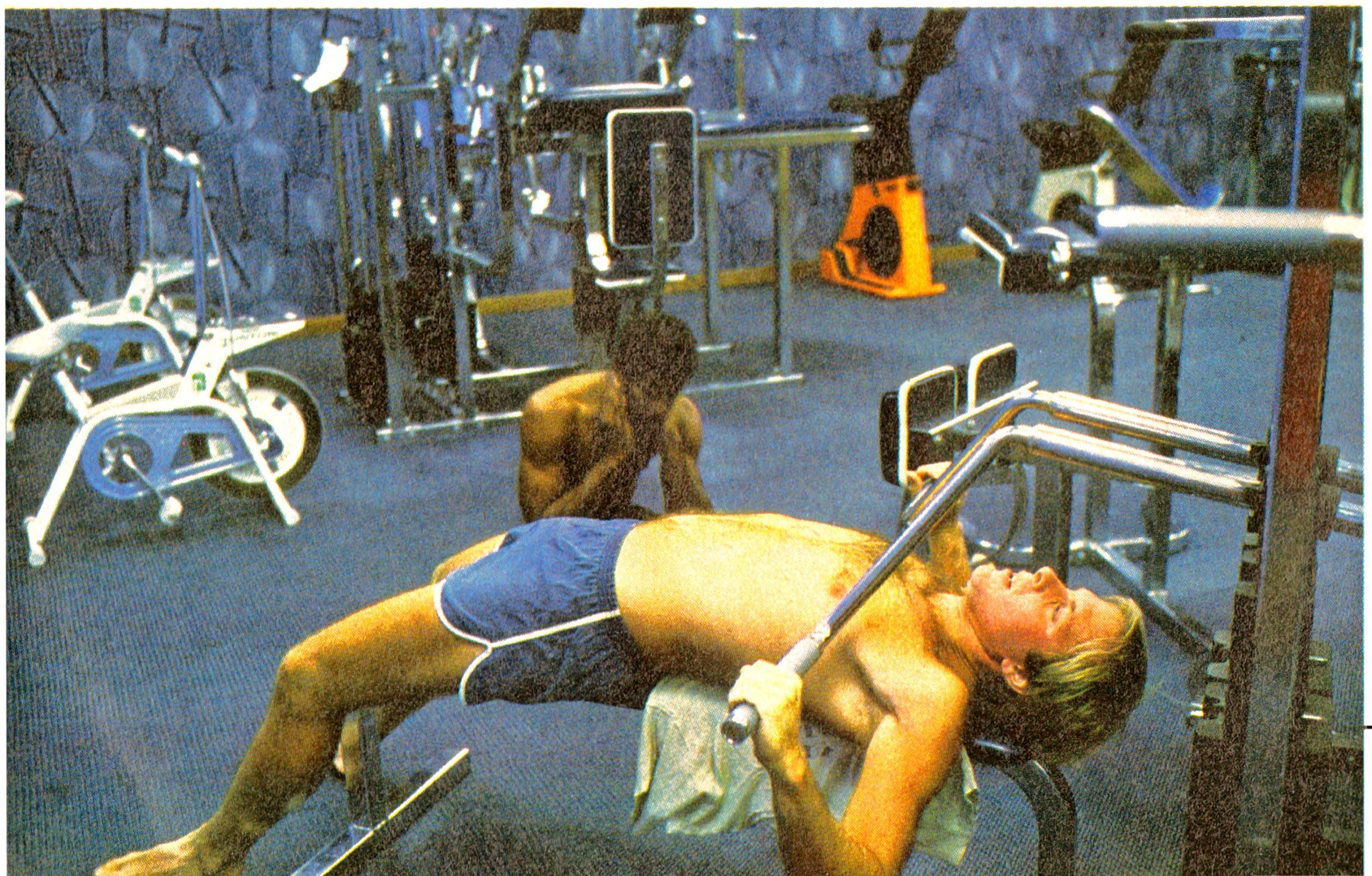
along with a variety of colorful personalities. The names may not be household words elsewhere, but here's a very brief sampling of Silicon Valley movers and shakers:

- W. J. "Jerry" Sanders, III, the silver-maned, 44-year-old supersalesman who started Advanced Micro Devices in his dining room and built it into one of the most aggressive chip makers in the Valley. The king of razzle-dazzle, Sanders runs his company on the philosophy of the late football coach Vince Lombardi, namely, winning is everything. A poster in his office reads "Yea though I walk through the valley of the shadow of death I fear no evil for I am the meanest son of a bitch in the Valley."
- Charles Sporck, the cigar-smoking manufacturing whiz who created National Semiconductor Corporation and turned it into one of the world's largest manufacturers of semiconductors. Once known as the "Japanese" of the Valley because it could copy anything and make it cheaper, National has developed its own track record as an innovator.
- Robert Noyce, the brilliant scientist who helped develop the transistor with William Shockley and the integrated circuit at Fairchild Camera and Instrument Company, and then took two research assistants with him and formed Intel Corporation, where the microprocessor chip was invented. Noyce, Andrew Grove, and Gordon Moore started Intel with a staff of eight, and under an unusual three-man management arrangement, built it into a $1-billion firm.

Along El Camino Real (the old main highway) neon signs announce motels, small businesses, and fast-food emporiums.

- Nolan Bushnell, the young engineer who invented a game you could play on your television set. He called it Pong, named his little company Atari, and made electronic games that turned the arcade business on its ear. Bushnell sold out to Warner Communications and plowed his millions back into a string of electronic pizza parlors.
- The two Steves—Jobs and Wozniak—who, as boyhood chums and college dropouts, built a computer the size of a typewriter for some friends in the Homebrew Computer Club. Unable to keep up with the demand, they sold an old Volkswagen van and a programmable calculator for $1300 and launched their own company, whimsically called Apple. The rest, as they say, is history—and sales last year were more than $300 million.

Fringe benefits for Rolm Corporation employees include tennis, indoor/outdoor pools, and a gym that would make Pumping Iron author Arnold Schwarzenegger smile.



Electronic Geography

In some respects Silicon Valley is as much a state of mind as it is a place—a symbol of the American know-how and technological innovation that is still king of the mountain on a worldwide scale. You won't find it on any maps; there are no signs to tell you when you're entering or leaving it. Geographically it lies within Santa Clara County, a narrow strip that starts on the edge of the Bay, 30 miles south of San Francisco at Palo Alto, the handsome peninsula city that is also the site of the valley's intellectual wellspring—Stanford University.

Between Palo Alto and San Jose (the huge southern anchor of the Bay Area, population: 610,000) lie a succession of similar-looking, middle-sized communi-

ties that make up the heart of the electronics industry: Los Altos, Mountain View, Sunnyvale, Santa Clara, and Cupertino. Once the fruitbasket of America, the cities are now reflections of the industries they've spawned; they're clean, scrubbed-looking, and for the most part vainly struggling for a sense of past (great portions of them were mud flats and orchards as recently as 30 years ago). If you know Southern California, you'll recognize the area as a miniature Orange County: horizontal communities with wide streets and low buildings (three stories is a high rise here). The dominant architecture is suburban modern—fast-food restaurants, shopping centers, and vast acres of industrial parks that have sprouted their own architectural image. It's a melange of tilt-up buildings and modern California Mission style (broad, sloping red-tile roofs), and occasionally a designer gem such as Digital Equipment's black cube or Qume's dramatic red structure with its unusual atrium interior. There are no smokestacks for miles around.

Just about anyone who's anyone in the electronics industry is represented here. IBM, Control Data, Digital Equipment, and Xerox (to name only a few of the big companies) all have major plants or research centers in the Valley. Foreign companies have come to get a piece of the high-tech action they can't get at home: Siemens of West Germany, Honeywell-Bull of France, and Fujitsu of Japan own chunks of important Silicon Valley companies. Two of the top U.S. personal-computer manufacturers, Apple and Atari, are headquartered here, as are a slew of other, lesser-known microcomputer makers and dozens of firms that specialize in military electronics hardware. Needless to say, such a concentration attracts a wide spectrum of electronic peeping-toms—everyone from industrial spies to the Soviet KGB.

The Personnel Track

Electronics pervades virtually every aspect of Valley life. Streets are named after semiconductors and the huge Vallco Shopping Center in Cupertino has erected a permanent display that chronicles highlights from the Valley's short but happy electronics history. "If you live in the Valley, two out of three of your neighbors work at one of the electronic firms," says Jim Schmidt, Human Resources Manager for Apple Computer. Schmidt and other personnel managers say the demand for skilled people in the Valley is nearly insatiable, a condition that last year's dip in semiconductor demand barely affected. This creates some intense salary pressures. Electrical engineers fresh out of college command salaries of $25,000, enough to bring tears to the eyes of the average liberal-arts major. Top salaries can exceed $100,000 for certain engineering specialists, although the average for good, experienced people is more in the range of $50,000 to $60,000. Even printed-circuit-board designers, performing draftsmen-type work, can earn $2500 a month if they have any college background, Schmidt says. Companies advertise on television, radio, and billboards for skilled workers.

All of this has an interesting impact on labor relations. If laissez-faire is the prevailing business philosophy in the Valley, then laid-back is the equivalent in employer-employee relations. Valley firms don't have Personnel Departments, they have Human Relations Departments (which is supposed to be less authoritarian). Dress codes are virtually extinct—at many places jeans and Birkenstock sandals are considered dress-up. Flex-time (letting employees choose the time, within limits, to start and end their work days), four-day weeks, and liberal sabbatical policies are common at many Valley companies. Like Rolm, most firms have a bewildering number of fringe benefits, recreational facilities, and informal access to top management. Tandem Computers, one of California's fastest-growing companies, throws a beer party every Friday afternoon for all its employees, including the top executives. At Apple Computer, the egalitarianism goes right down the line. Apple doesn't have secretaries, it has Area Associates. For some time, Apple managers and executives dropped their titles, regaining them only because of the confusion it caused outside of the company.

Free coffee and soft drinks on the job are de rigueur at most places, but Apple goes one better: it gives its employees a free computer if they promise to learn how to use it. Advanced Micro Devices, on the other hand, seeks employee loyalty with your basic "cash and bash" approach—last year a 20-year-old assembly-line worker won $240,000 in a company lottery. AMD has thrown several of the most lavish company parties in Bay Area history (the tab for one ran to $350,000, including the caviar, champagne, and a 50-foot dessert table).

The purpose of these perks is to help companies get and keep good people: when six months on the job is a long time, lowering turnover helps boost productivity. Does it work? Sort of. Personnel people say there's no substitute for challenging work, but companies like Rolm and Apple claim their turnover rate is far below the industry average, which runs about 25 to 30 percent overall but can be higher than 100 percent at some companies with heavy assembly-line employment.

Beneath the sugar-coated employee benefits is a tough, management-by-objectives policy that sets goals and then lets managers achieve them in whatever way they like. But achieve them they must, or they'll be looking for work elsewhere. The highly touted flexible-hours system often includes an implicit expectation that employees put in 10- or 12-hour workdays. Even during the occasional rough times, many Valley firms try to hang on to a no-layoff policy; Intel, for example, recently jacked up the work week for its "professionals" from 40 to 50 hours.

Electronic Seeds

Why has this little California valley become a world center of electronics? Besides the ambience of the area—it really *is* a nice place to work—most people point to the stimulation provided by Stanford University. Silicon Valley actually has two beginnings: one pre-World War II and one postwar.

Frederick Terman, now a retired Stanford engineering professor, is credited with the early efforts to build the

Valley into a technological center. Distressed by the "brain drain" that took Stanford's engineering graduates to the East Coast for jobs, Terman convinced two of his graduate students to stay home and set up business next to the campus. William Hewlett and David Packard started their company in Packard's Palo Alto garage in 1938, and Hewlett-Packard has gone on to become one of the biggest and most successful makers of electronic equipment in the world, with annual sales now at more than $2 billion.

It was the invention of the transistor in 1951, however, that ushered in the era of solid-state electronics and modern development in the Valley. William Shockley, co-inventor of the device at Bell Laboratories, returned to Palo Alto to set up the Shockley Transistor company. Before long, a half-dozen of Shockley's bright young scientists and engineers left to form the semiconductor division of Fairchild Camera and Instrument Company. Under the leadership of C. Lester Hogan, Fairchild developed the integrated circuit and set in motion two characteristics that still typify the Valley: technological innovation and the restless urge of employees to split up and start up new companies.

In many respects, Fairchild is the fountainhead of the modern Silicon Valley. More than 40 companies are directly descended from former Fairchild employees—Hogan's Heroes, they're called. New companies are starting up every day in the Valley as bright young men and women spot an unfilled niche and scrape up the capital to jump in. And despite the valley's short history, legacies have developed. Gene Amdahl, a former IBM designer and the founder of Amdahl Corporation, a multimillion-dollar mainframe manufacturer, has passed his entrepreneurial blood on to his son, Gene, vice president of Magnuson Systems Corporation, another booming valley computer company.

Sometimes the old guard chucks it in and starts over. Amdahl, who made his reputation by "filling in" weaknesses in the IBM product line and creating IBM-compatible systems, recently left his name on the company's massive buildings to go out and do it one more time. Likewise, Alan Shugart (Shugart Associates), who, after making his name an industry standard for floppy-disk drives, sold out to Xerox to support his new enterprise, Seagate Technology.

But among the old-timers here (ten years makes you an old-timer), there's a feeling of nostalgia as the industry changes. "The big names are all grown up now," says one long-time denizen of the Valley. "The young kids of ten years ago are now middle-aged kids," he says, adding wistfully, "You just don't see as many interesting faces these days." □

Photos on pages 103, 105, 106, and inset photo on page 104 by Lorraine Rorke; photo on page 104 by George Hall.

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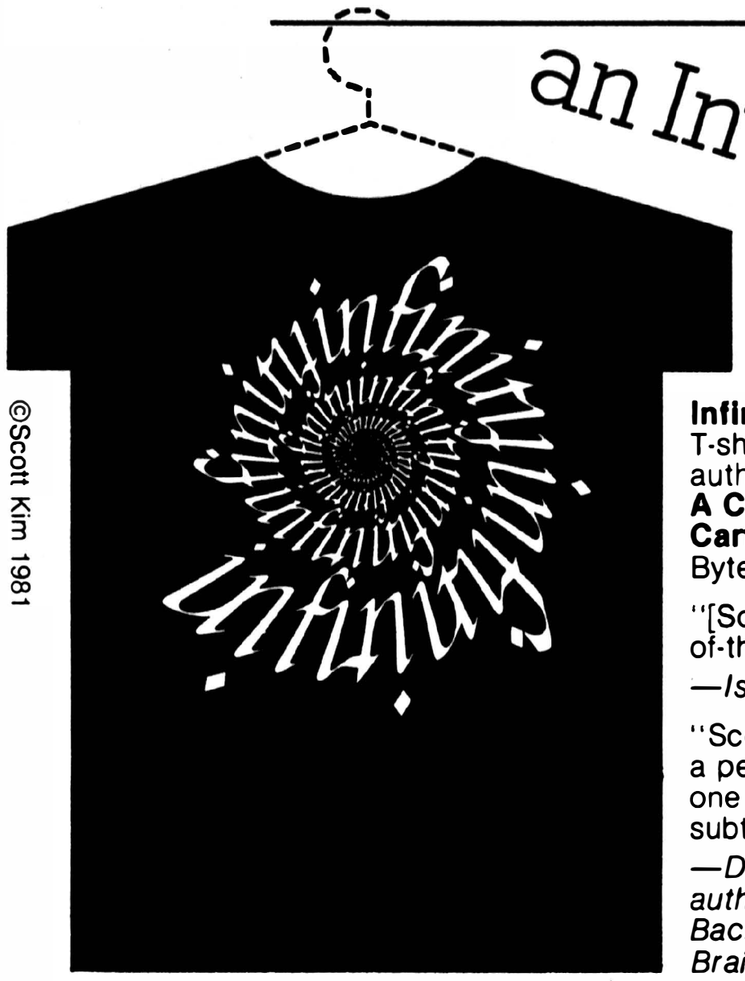

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A Beginner's Guide to BASIC Programming Part 2

by Elizabeth Hughes

In part 1 of this article I introduced some fundamental BASIC commands, which are summarized in the text box on page 117. (See "A Beginner's Guide to BASIC Programming, Part 1," February, 1982 *Popular Computing*, page 78.) This month I'll discuss several other helpful programming structures you can use with BASIC.

Loops, subroutines, and arrays are three of the most useful programming tools. Loops make the computer perform an operation repeatedly; subroutines separate operations or calculations from the main line of a program; and arrays reference large quantities of data using a single indexed variable name instead of many ordinary variables.

It's best to see these techniques used in the context of a program. Let's consider a program to figure end-of-term grades for a class of ten students. (The complete program is in the listing on page 113.) Two one-hour exams (with numeric grades, like 84 or 67) and a paper (with a letter grade, like A or C) each count for 20 percent of the course grade. The final examination (another numeric score) accounts for the other 40 percent. Using loops, subroutines, and arrays this program can be made short and efficient.

The opening lines would read as follows:

```
100 REM Program to Figure Student
    Course Grades
110 REM Initialization
120 LET P$=" ":C=0
```

The first two lines label the program and identify the initialization section. Only two variables (P$ and C) are needed, because all the student data will be handled by arrays.

Elizabeth Hughes is a freelance writer from Doraville, Georgia.

Arrays

Because arrays let you store and access data by number, they make it easy to correlate items. In this example, grades will be correlated with a student's name. The simplest array is called one-dimensional; think of it as a list or table.

A *dimension* statement (DIM) defines an array, giving the array's name and the number of items it is to contain. Data can be stored in or retrieved from the array by giving the name of the item and a subscript (number) corresponding to its position within the array. For instance, DIM L(25) would indicate that there are 25 locations in array L, and L(14) would specify the fourteenth item in array L.

> Loops, subroutines, and arrays are three of the most useful programming tools.

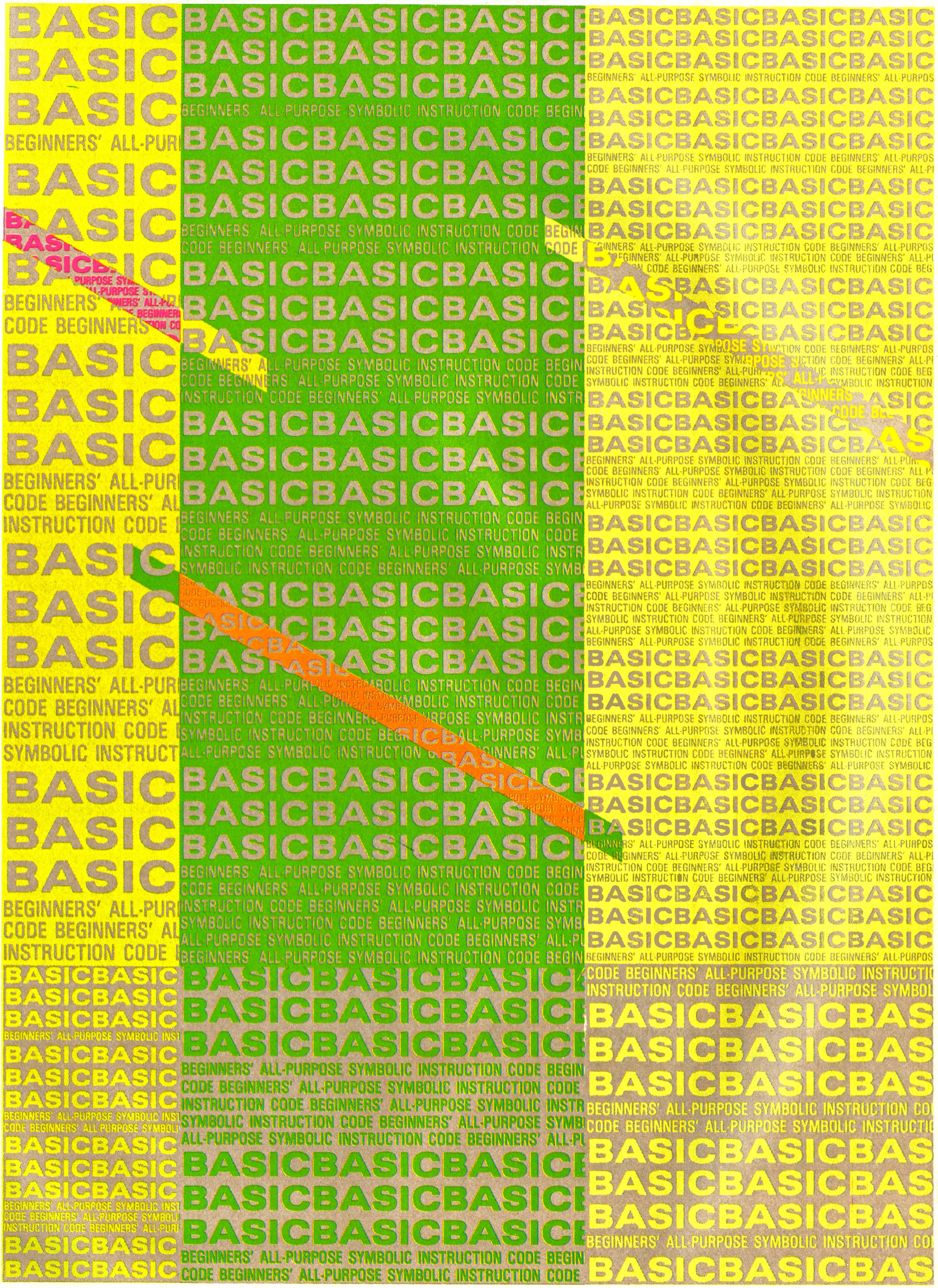
Some computers are programmed to employ a *zero subscript* in arrays. When given the command DIM L(25), they actually set aside 26 locations: twenty-five that are accessed under the names L(1) through L(25), and one more referred to as L(0). This is sometimes useful, but seldom necessary in programming.

The most common arrays are two-dimensional. A two-dimensional array can be thought of as a rectangular grid of rows and columns into which data can be stuffed, similar to mailboxes on a post office wall. "Dimensioning" this array instructs the computer to allocate storage that can be accessed in terms of the row and column where an item is located, much as a mailman finds a specific mailbox. For instance, if the wall of mailboxes is the two-dimensional array M(20,20), the box that is five rows down and seventeen columns across is the location M(5,17). Some implementations of computer lanugages allow for three-dimensional and multidimensional arrays, but two-dimensional arrays are what we'll use here.

Most versions of BASIC require that numeric data and string (alphabetic) data be stored in separate arrays. Therefore, this program requires two arrays: one for string data (students' names and final course grades) and one for numeric data (grades received throughout the term). The next step, then, is to dimension these arrays.

```
130 DIM R$(10,2): DIM D(10,5)
```

The dollar sign in the array name R$ indicates the array will be used for string data. Line 130 instructs the computer to reserve twenty locations for the array R$ and fifty for the array D. Any item in either array can be specified by giving its array name and subscripts. It's easy for us to think of this storage as if it were neatly arranged in rows and columns, as shown in the figure on page 114, although the actual storage used by the computer may be organized very differently.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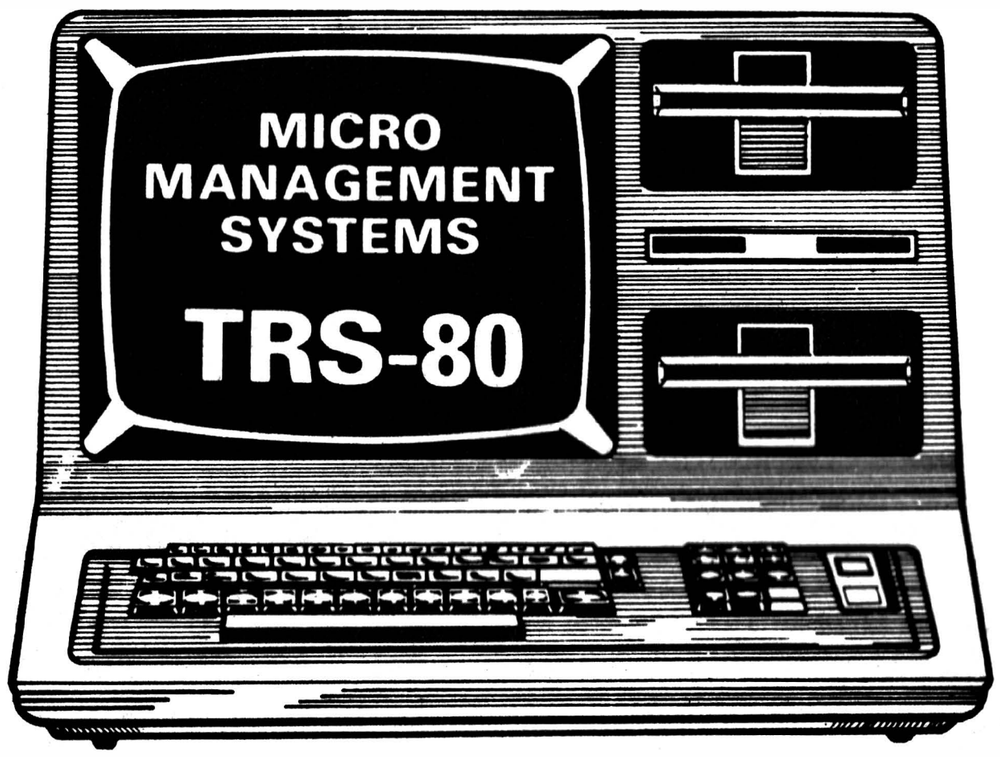

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Because dimension statements can quickly allocate large amounts of storage, you must use arrays with care to avoid unintentionally exceeding available memory. You must also keep straight what data are stored in which array locations. To avoid confusion, a remark statement (REM) telling how the storage is used should accompany the remarks identifying the variables.

```
140 REM P$, PAPER GRADE: C
    HELPS GET AVG;R$,
    NAMES,FINAL GRADES
150 REM D,HR EXAM 1,HR
    EXAM 2,PAPER,FINAL
    EXAM, AVG
```

Output

Now we're ready for the body of the program. First we must decide what output is wanted. Someone using this program would probably prefer to have all the information printed. The program will do calculations for one student at a time, so the results can be printed as soon as they are computed. Headings, then, can be output immediately.

```
160 REM OUTPUT HEADINGS
170 LPRINT TAB(2) "NAME"
    TAB(12) "HE#1" TAB(19)
    "HE#2" TAB(27) "PAPER"
    TAB(35) "FINAL";
180 LPRINT TAB(42) "AVERAGE"
    TAB(54) "GRADE"
190 LPRINT " ": LPRINT " "
```

Line 160 identifies the task of this section, and the next two lines cause the headings to be printed. LPRINT TAB specifies exactly where information is to be printed on a line. The number in parentheses after LPRINT TAB indicates where the first printed character is to be located. Then the desired output is given, just as in the more familiar PRINT statement. The tab number (2) in line 170 allows a small margin before beginning to print. Since instructions for all the headings won't fit on a single line of code, line 170 ends with a semicolon. This prevents the printer from advancing to a new line before printing the material in line 180. The tab number (42) in line 180 specifies the position on the printed line for the next heading.

To print the information in columns under the headings, it's necessary to count the number of spaces required by the headings and by the information to be printed beneath them. The student names will be of different lengths, so you must leave sufficient space in the name column to print the longest name and still leave a few blank spaces before the first column of grades. The columns of grades can be centered under the other headings.

Line 190 outputs two blank lines to set the heading apart from the data. This isn't necessary, but it can make the printout easier to read. Notice that instead of simply using the command LPRINT, it is necessary to use LPRINT " ". Some computers are programmed to ignore print commands to line printers if there is no output specified. By instructing the computer to print a space, this command satisfies the need for something to output and produces the desired blank lines.

The complete grade-averaging program.

```
100 REM PROGRAM TO FIGURE STUDENT COURSE GRADES
110 REM INITIALIZATION
120 LET P$ = " ":C = 0
130 DIM R$(10,2): DIM D(10,5)
140 REM P$, PAPER GRADE; C HELPS GET AVG; R$,NAMES,FINAL GRADES
150 REM D, HR EXAM 1, HR EXAM 2, PAPER, FINAL EXAM, AVG
160 REM OUTPUT HEADINGS
170 LPRINT TAB(2) "NAME" TAB(12) "HE#1" TAB(19) "HE#2" TAB(27) "PAPER"
    TAB(35) "FINAL";
180 LPRINT TAB(42) "AVERAGE" TAB(54) "GRADE"
190 LPRINT " ": LPRINT " "
200 REM FILL ARRAYS
210 FOR I = 1 TO 10
220 READ R$(I,1),D(I,1),D(I,2),P$,D(I,4)
230 GOSUB 320
240 LET D(I,5) = (D(I,1) + D(I,2) + D(I,3) + 2*D(I,4))/5
250 LET C = C + D(I,5)
260 GOSUB 390
270 LPRINT TAB(2)R$(I,1);TAB(12)D(I,1);TAB(19)D(I,2);
280 LPRINT TAB(27)D(I,3);TAB(35)D(I,4);TAB(43)D(I,5);
290 LPRINT TAB(54)R$(I,2):LPRINT " "
300 NEXT I
310 GOTO 450
320 REM SUBROUTINE TO CONVERT PAPER GRADE TO NUMBER
330 IF P$ = "A" THEN D(I,3) = 95
340 IF P$ = "B" THEN D(I,3) = 85
350 IF P$ = "C" THEN D(I,3) = 75
360 IF P$ = "D" THEN D(I,3) = 65
370 IF P$ = "F" THEN D(I,3) = 55
380 RETURN
390 REM SUBROUTINE TO CONVERT STUDENT AVG TO LETTER GRADE
400 IF D(I,5) >= 90 THEN R$(I,2) = "A":RETURN
410 IF D(I,5) >= 80 THEN R$(I,2) = "B":RETURN
420 IF D(I,5) >= 70 THEN R$(I,2) = "C":RETURN
430 IF D(I,5) >= 60 THEN R$(I,2) = "D":RETURN
440 LET R$(I,2) = "F":RETURN
450 REM OUTPUT CLASS AVERAGE
460 LPRINT " "
470 C$ = "THE CLASS NUMERIC AVERAGE IS ##.##."
480 LPRINT USING C$;C/10
490 DATA ATKINS,68,74,C,81,BLACK,82,87,B,91,DILL,54,49,D,57
500 DATA FISH,89,94,A,97,"JONES,C",79,72,C,77
510 DATA "JONES,G",69,73,C,70,LAMBERT,58,67,D,63,NOEL
520 DATA 81,87,B,90,PELL,86,78,C,79,SIMS,54,67,D,63
530 END
```

Loops

After printing the headings, it's time to fill the arrays with data.

```
200 REM FILL ARRAYS
210 FOR I=1 to 10
```

The FOR statement in line 210 opens a FOR . . . NEXT loop. It supplies an *index variable*, I, which is assigned an initial value of 1. At the end of the loop, which will be line 300 in this example, the command NEXT I will cause I's value to be changed. Then the FOR statement will be executed again (looping) and the value of I compared

with the maximum value shown (in this case, 10). When I is greater than 10, the operation will have been repeated as many times as necessary, and control will be transferred out of the loop. FOR . . . NEXT loops usually increase the index value by 1 if no other change is specified. To vary I in some other way, such as subtracting 1 or adding 3 at each pass through the loop, all that's required is to specify the STEP. For example, FOR statements could read FOR J=100 to 0 STEP −1, or FOR K=0 TO 1000 STEP 100. Whenever the NEXT statement was executed, the value of the index variable would be changed as the STEP part of the command indicated. The most common change is to increase the index variable by +1, and that STEP is assumed if none is formally given.

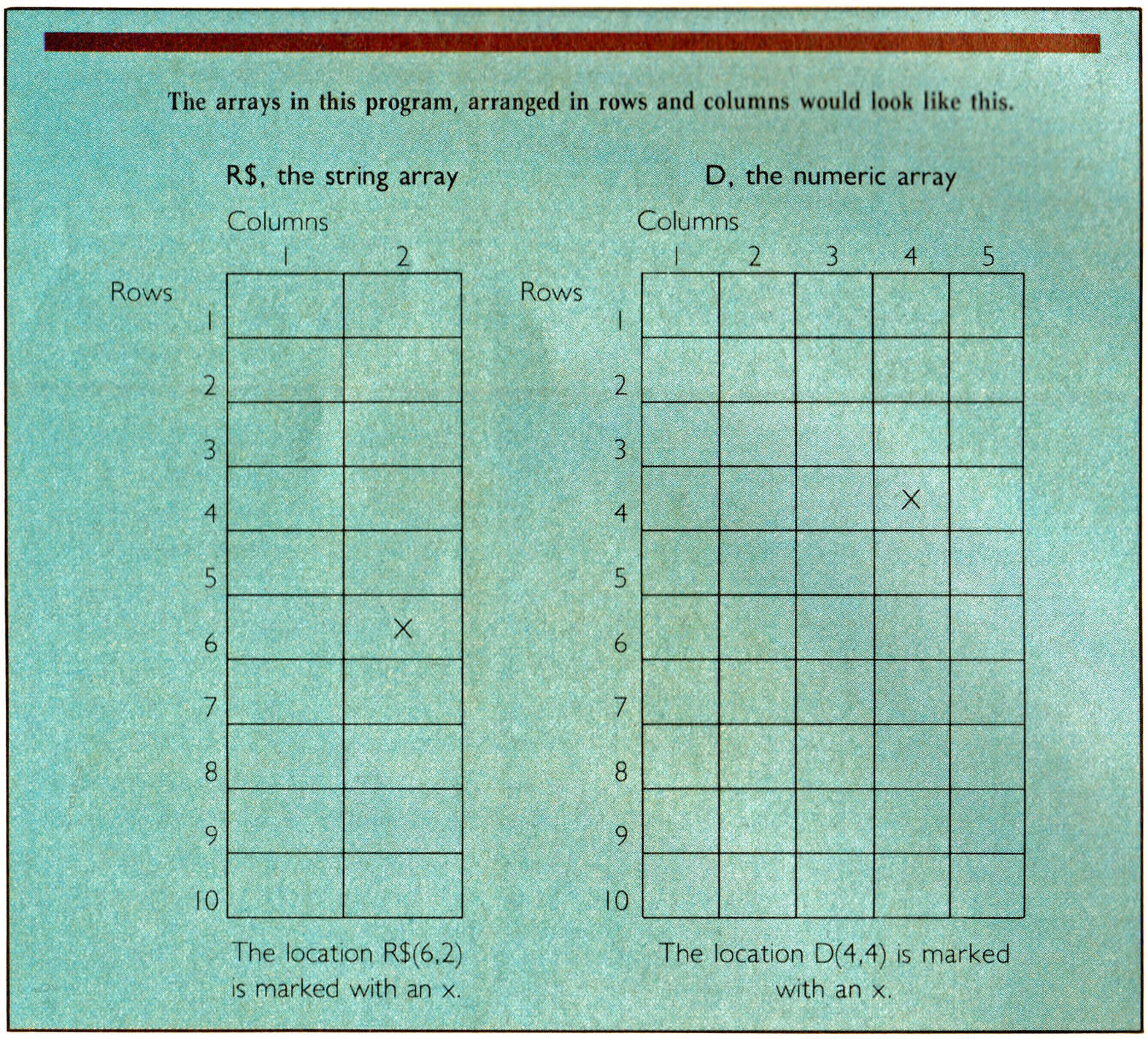
Now it's time to get some data for the arrays. I have used DATA and READ statements for this purpose. The DATA statements will be added at the end of the program, but the READ statement belongs here.

```
220 READ R$(I,1),D(I,1),D(I,2),P$,
    D(I,4)
```

This causes the program to get data, starting with the first item in the first DATA statement, and to store the data in the array locations named. Since the first subscript in each case is I, the loop index variable, the array location filled will depend on which cycle through the loop is in progress. Information is stored in the arrays in the order in which it would appear in the grade book: name, first hour-exam grade, second hour-exam grade, paper grade, and final-exam grade. The program fills a row of the array with one student's data on each pass.

The paper grade belongs in D(I,3), but it is a letter grade and can't be stored in this array until it has been converted to a numeric equivalent. The variable P$ holds this grade until the conversion can be performed by a subroutine.

The arrays in this program, arranged in rows and columns would look like this.



Subroutines

Subroutines simplify subdividing and organizing a program's operations. In this program, subroutines are used to convert letter grades to numeric values and vice versa, but it is also possible to design an entire program around subroutines. A subroutine is implemented, or "called," by the command GOSUB followed by a line number. This causes execution of the commands starting at the line named and continuing until a RETURN command is reached. Control then returns to the line following the subroutine call.

Let's call the subroutine to convert the paper grade now.

```
230 GOSUB 320
```

At the GOSUB command, control transfers to line 320, where the conversion begins. The RETURN command at the end of the routine (line 380) instructs the program to transfer control back to the line following the subroutine call (in this case line 240). If the subroutine was called from another line in the program, it would not return to line 240, but to whatever line followed the one that called it. Similarly, if the program were modified, changing some of the line numbers, the subroutine would still return to the correct line, i.e., to the one after the GOSUB command. The subroutine itself will be discussed in greater detail later.

On returning to line 240, the program calculates the student's numeric average and stores it in D(I,5).

```
240 LET D(I,5)=(D(I,1)+D(I,2)+
    D(I,3)+2*D(I,4))/5
```

The grades received for the first two exams and the paper are added to the final-exam grade multiplied by 2; then the result is divided by 5 to find the student's average. The final-exam grade is multiplied by 2 because it counts for 40 percent of the course grade, while the other grades only count for 20 percent each.

Other calculations are also possible. A line can be included here, for example, to maintain a running total of the student averages for use in figuring the class average.

```
250 LET C=C+D(I,5)
```

C was initialized at 0 in line 120. At each pass through the loop, line 250

adds the current student's average to C. When the loop completes its operation, C will be the total of the student averages, and, divided by ten (the number of students), it will give the class average.

To determine the student's final course grade, we must convert the student's average into a letter grade. A subroutine is used here also.

```
260 GOSUB 390
```

Like the other subroutine call, this causes the computer to execute the commands beginning at the line named (390) and return to the next line of code (270) when the RETURN command is reached. This subroutine (which will also be discussed in detail later) stores its result, the student's letter grade for the course, in R$(I,2).

Now all the array locations having a first subscript of I (in this case, 1, since we are on the first pass through the loop) should be filled with data. R$(I,1) holds the student's name (read from a DATA statement), and R$(I,2) has the course grade that was stored there by the subroutine called in line 260. D(I,1) and D(I,2) hold the hour-exam scores read from DATA statements; D(I,3) contains the numeric value assigned the paper grade by the subroutine called in line 230; D(I,4) has the student's final-exam score; and D(I,5) holds the student's average as computed in line 240. We can now print the grade information for the first student.

```
270 LPRINT TAB(2)R$(I,1);
    TAB(12)D(I,1);TAB(19)D(I,2);
280 LPRINT TAB(27)D(I,3);
    TAB(35)D(I,4);TAB(43)D(I,5);
290 LPRINT TAB(54)R$(I,2):
    LPRINT " "
```

The array names and coordinates given in these lines specify what is to be output. Since they are not in quotation marks, the values of these variables will be printed. As before, the LPRINT " " at the end of line 290 inserts a blank line after each line of student information.

This is the last operation the program must perform repetitively, so we can close the loop.

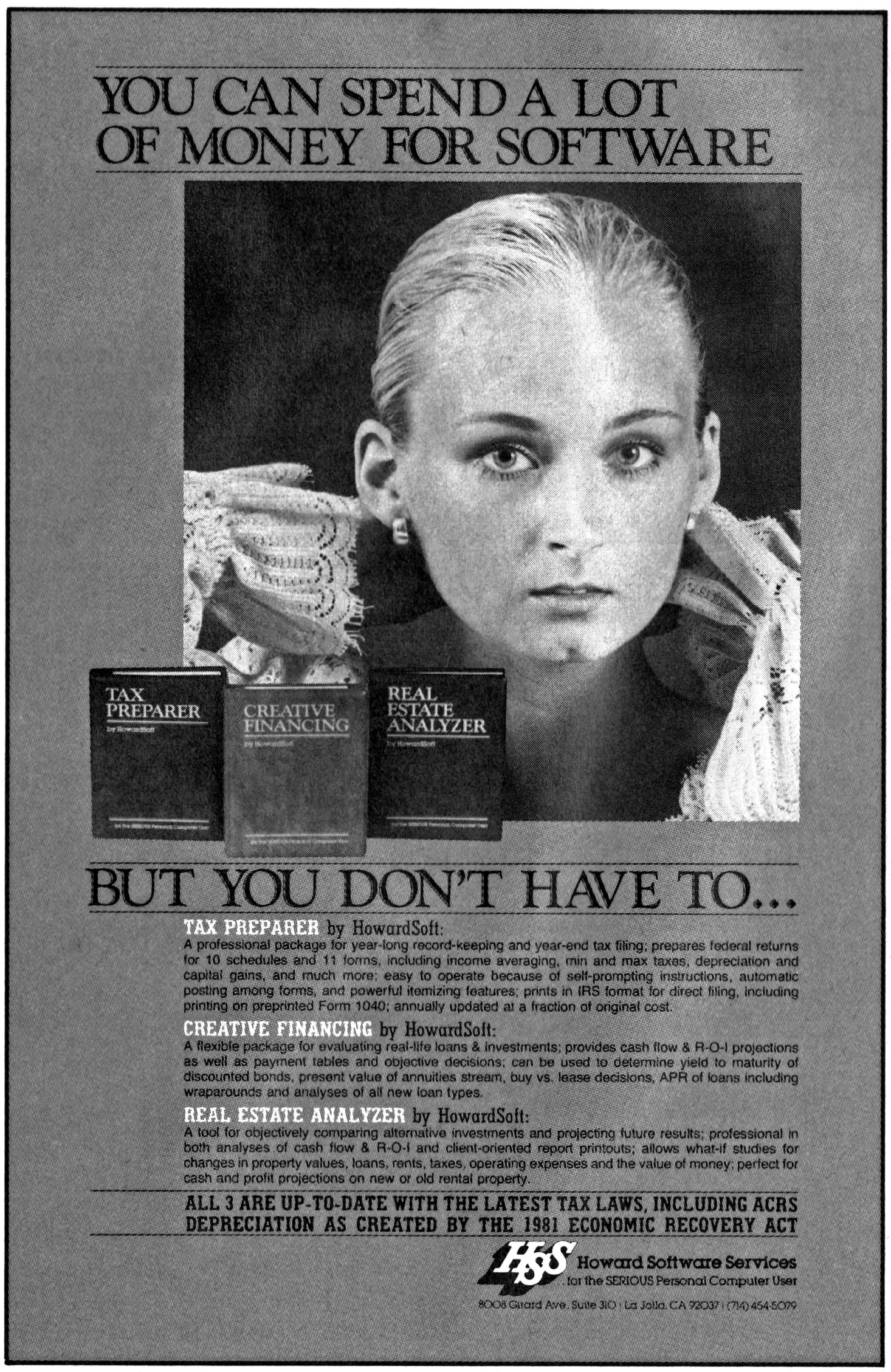
```
300 NEXT I
```

At this command, the next value of I is determined, and control is returned to the FOR statement. If I is still within the limits set in the FOR statement, the operations inside the loop are repeated. When the loop completes its operation, control passes to the line following this NEXT command.

```
310 GOTO 450
```

This directs the program to skip over the code for the subroutines and transfers control to the final phase of the program, which computes and prints the class average. With line 320, the code for the subroutines begins.

```
320 REM SUBROUTINE TO
    CONVERT PAPER GRADE
    TO NUMBER
330 IF P$="A" THEN D(I,3)=95
340 IF P$="B" THEN D(I,3)=85
350 IF P$="C" THEN D(I,3)=75
360 IF P$="D" THEN D(I,3)=65
370 IF P$="F" THEN D(I,3)=55
380 RETURN
```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Line 320 identifies the subroutine. Then lines 330 through 380 examine P$, the string variable used for the paper grade, and, when the correct letter grade is found, D(I,3) is given the assigned numeric value. Extra conditions could be included to provide for letter grades modified by plus (+) or minus (−) or for grades like "S" (Satisfactory) or "U" (Unsatisfactory). The value of P$ is compared with each possible letter grade. Since only one of the choices will be correct, control drops through the other comparisons to the RETURN command at line 380.

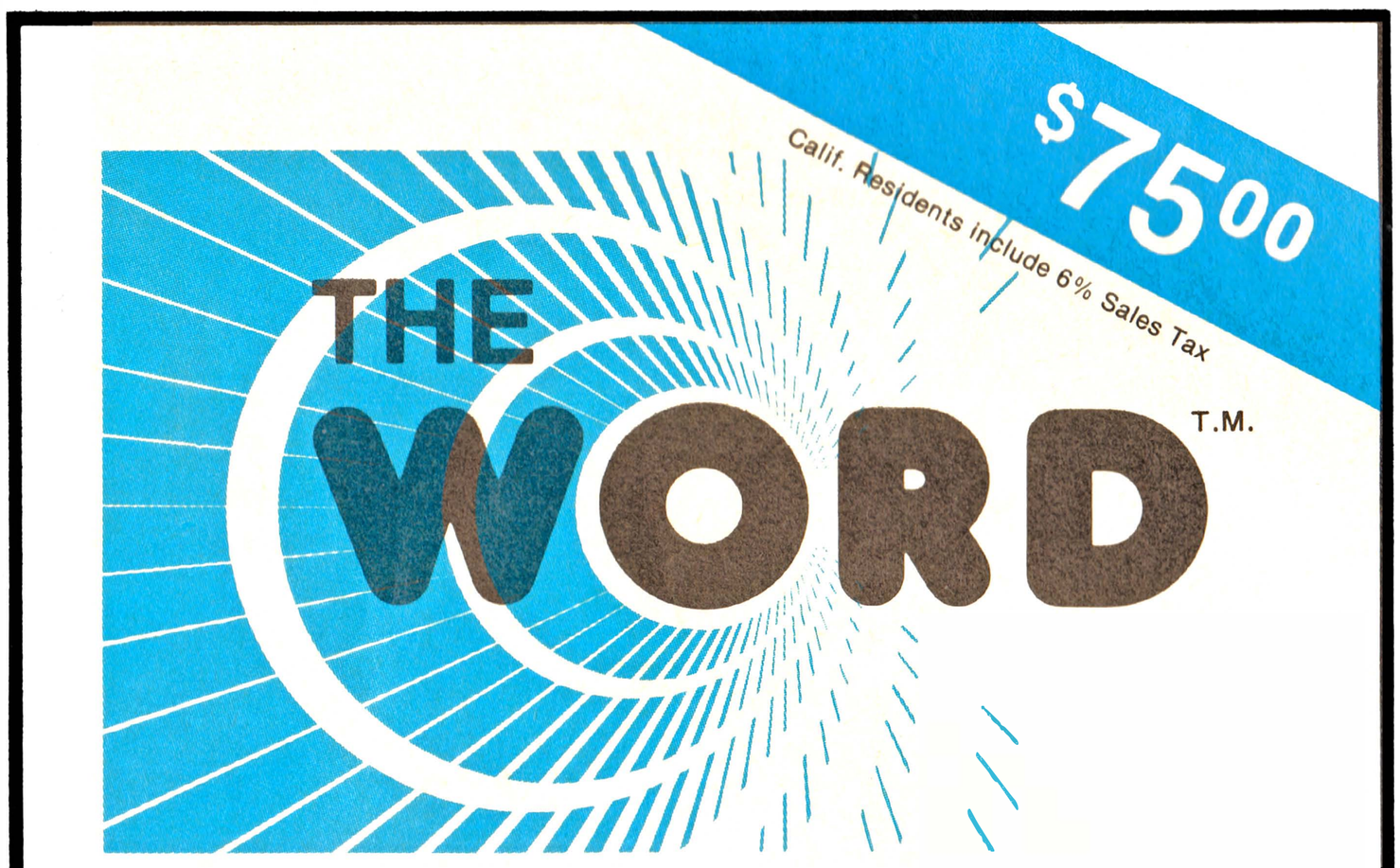
Next comes the subroutine to convert the student's average into a letter grade.

```
390 REM SUBROUTINE TO
    CONVERT STUDENT AVG
    TO LETTER GRADE
400 IF D(I,5)>=90 THEN R$(I,2)
    ="A":RETURN
410 IF D(I,5)>=80 THEN R$(I,2)
    ="B":RETURN
420 IF D(I,5)>=70 THEN R$(I,2)
    ="C":RETURN
430 IF D(I,5)>=60 THEN R$(I,2)
    ="D":RETURN
440 LET R$(I,2)="F":RETURN
```

This performs a conversion similar to the one in the previous subroutine, by comparing the student's average with grade cutoff scores. The resulting letter grade is stored in R$(I,2). I have used one of the standard grading systems, but another system could be used by replacing the grade cutoff numbers with the preferred ones.

The main difference between the two subroutines is in the handling of RETURN. Many microcomputer BASICs allow more than one statement on the same line if the statements are separated by the correct punctuation. On my system a colon is used. Versions of BASIC that allow this often treat IF statements in a special way. An extra statement added to a line usually is treated as if it had been assigned the next line number in succession. Line 120, combining variable initializations into a single line, is an example of this. With IF statements, however, the extra statement on the same line is only executed when the condition in the IF part of the statement is true. In other words, when line 400 finds a student whose grade average is *not* 90 or higher, it does not return—instead, control passes to the next IF statement. Only when the condition of the IF statement is met will the RETURN shown on the same line be executed.

Not all BASICs have this feature. If yours doesn't, or prefers to be given a line number (not an operation, like LET R$(I,2)="A") after THEN, there are simple remedies. The program will operate almost identically if you put the statements in the form IF D(I,5)>=90 THEN *line*, where *line* is a line number elsewhere in the program. At the new line, put LET R$(I,2)="A" (or whatever is appropriate), and on the following line put RETURN. Only if the necessary condition is met will R$(I,2) be filled with a letter grade and control returned to the statement after the subroutine call. The simplest approach, of course, would be to test for the lowest average first. If the average isn't less



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than 60, you could ask if it is less than 70 without the possibility that it would be below 60. Continuing this way, the decisions could be handled as they are in the earlier subroutine, using only a single RETURN command at the end.

Once a letter grade has been assigned, an entire row in each array has been filled, so on return from this subroutine the information is printed by lines 270 through 290. When the loop completes its operation, all the students' grades have been calculated and printed, and line 310 directs the program to resume operation at line 450, after the code for the subroutines.

Concluding the Program

Now the class average will be developed.

Commands introduced in "A Beginner's Guide to BASIC Programming, Part 1."

REM (Remark)	Used to identify sections of the program, give meanings of variable names, and make other comments that help the programmer, but are not executed by the program.
LET	Assigns value. LET A=B assigns the value of the variable B to the variable A. Similarly, LET A=A+1 assigns A a value +1 greater than its original value.
READ and DATA	READ accesses data provided in the program in DATA statements, reading from the first item listed to the last. For example, READ A,B would at its first execution take the first two values from the DATA statement elsewhere in the program, DATA 2,5,3,8.
INPUT	Tells the computer to accept data input from the keyboard. For example, at the command INPUT A,B the computer would wait for the user to enter two values (for example, 45,72) on the keyboard.
+,−,*,/,=	Mathematical operators for addition, subtraction, multiplication, division, and value assignment, respectively.
IF . . . THEN	Decision statement, requiring a comparison. For example, the command IF A=2 THEN 450 would transfer control to line 450 if A was indeed equal to 2, but otherwise would simply pass on to the next line in succession.
GOTO	Tells the program to execute the line number shown after the GOTO next and to continue processing from that line. For example, GOTO 130 would cause program execution to continue beginning at line 130.
PRINT and LPRINT	Statements causing output to a display or a printer, respectively. Material in quotation marks after a PRINT command is output exactly as it is; the values of variables or operations outside of quotes are output.
STOP	Halts program execution.
RUN	Causes the computer to attempt to execute the program entered.
LIST	Causes the computer to display or print the lines indicated (as in LIST 100-200) or the entire program code if no line numbers are given.
SAVE	Causes the program to be stored on disk or in other long-term memory.
LOAD	With a program name, calls up that program into the computer's memory from more permanent memory (tape, disk, etc.).

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```
450 REM OUTPUT CLASS
    AVERAGE
460 LPRINT " "
470 C$="THE CLASS NUMERIC
    AVERAGE IS ##.##."
480 LPRINT USING C$;C/10
```

Line 450 labels the section, and line 460 provides an extra blank line to separate the average from the student data. The LPRINT USING command in line 480 uses the format specified as C$ in line 470. The text is output exactly as it is, and the average (computed as C/10) is printed as two digits, a decimal point, and two more digits in the space indicated by the number signs (#) in the format. PRINT USING is most useful when dealing with dollar and cents figures that need to be aligned, but it is used here to show its form.

Now it's time to enter the DATA statements. These can be transcribed directly from the class roll book, giving name, first hour-exam grade, second hour-exam grade, paper grade, and final-exam grade, in that order.

```
490 DATA ATKINS,68,74,C,81,
    BLACK,82,87,B,91,DILL,
    54,49,D,57
500 DATA FISH,89,94,A,97,
    "JONES,C",79,72,C,77
510 DATA "JONES,G",69,73,C,70,
    LAMBERT,58,67,D,63,NOEL
520 DATA 81,87,B,90,PELL,86,78,
    C,79,SIMS,54,67,D,63
530 END
```

Subroutines simplify dividing and organizing a program's operations.

The data is read in sequence when the READ statement in line 220 is executed, taking five pieces of data for each student. Notice that the two Jones entries in lines 500 and 510 are put in quotation marks. Some BASICs will accept string data from DATA statements even if it isn't in quotation marks. This simplifies using data like the paper grades. However, since the program decides where one datum ends and the next begins by the punctuation separating them, any datum requiring punctuation must be put in quotes so the program will know it is a single unit. The existence of two Joneses in the class meant their first initials were needed to guarantee that the right grade was assigned to each, so their names, with initials, had to be enclosed in quotation marks.

At line 530 the program ends. The initialization section set up the variables and arrays needed; the loop in the body of the program filled the arrays with read and computed data, outputting results as they were calculated; and subroutines made the necessary conversions.

This program uses only one loop and keeps the subroutines separate, but more complex structures are possible. When writing programs that involve

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multiple loops, or subroutines called by subroutines, use extreme care. If you keep it clear which loop or which subroutine you're using, no problem will arise, but even experts know the anguish of inadvertent infinite loops or subroutine calls where the program goes off and gets lost. Problems like this will be few, though, if you understand the task.

Programming may be the world's least-advertised sport, but it's one of the best.

Summary

When you begin writing more complex programs, you become aware of the need for more powerful programming tools. Loops, subroutines, and arrays, introduced here, are among the essential ones. The FOR . . . NEXT . . . STEP loop structure provides a convenient way of getting the program to repeat an operation; the dimension statement lets you allocate storage whose contents can be accessed by giving an array name and suitable subscripts; and the GOSUB . . . RETURN structure lets you easily handle parts of an operation apart from the main line of the program. If specialized output is desired, PRINT TAB, PRINT AT, and PRINT USING offer alternatives to PRINT.

Because of its popularity in personal computing, BASIC has been developed to include many capabilities. Some of the fundamental commands and structures are discussed here and in Part I, but if you explore your system's BASIC you will find even more tools to make programming easier and more fun. When you're comfortable with loops, subroutines, and arrays, try experimenting with the additional commands you discover. And don't be surprised if you find it addictive. Programming may be the world's least-advertised sport, but it's one of the best. □

Illustration by Lew Fifield

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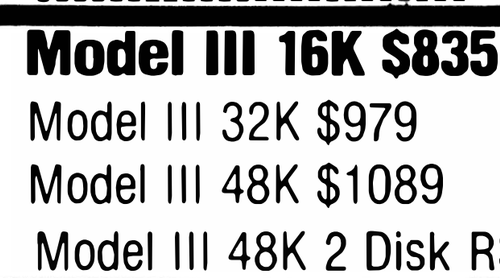

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Word

A Spelling Program to Eliminate the Curse of Noah Webster

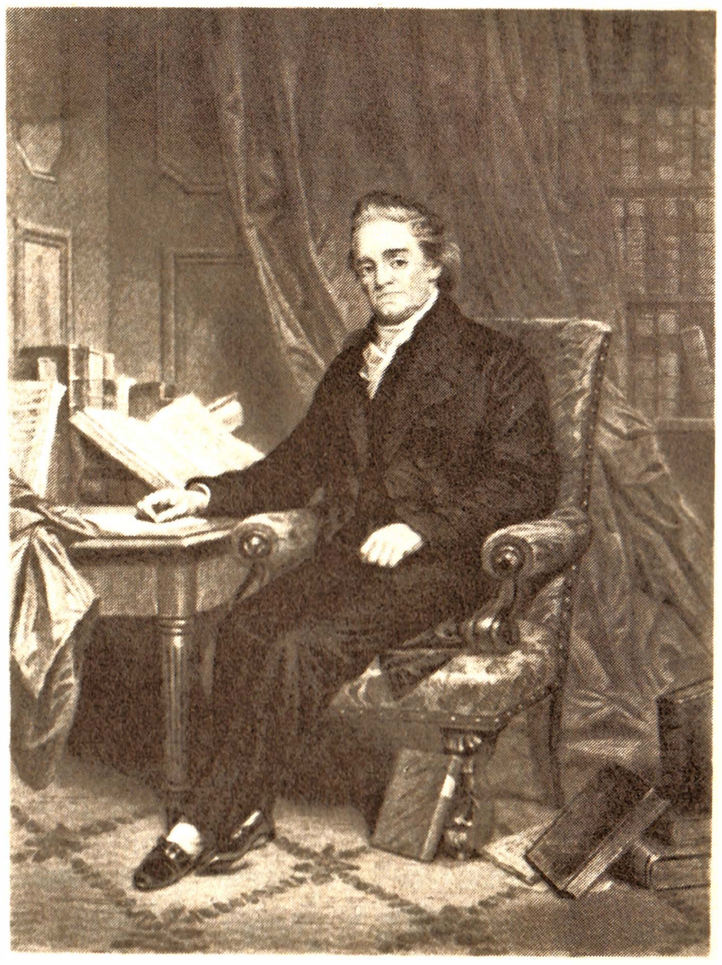
by Peter McWilliams

I've always had a fondness for Thomas Jefferson. Anyone who wrote the Declaration of Independence and said "I have nothing but contempt for anyone who can only spell a word one way" can't be all bad. I won't be spending much time on the Declaration in this article, but I will be discussing the subject of spelling a lot.

I'm an awful speller. I am so bad I don't even know when a word is spelled correctly. Ninety percent of the words I take the time to look up (and I do mean time; I'm lousy at alphabetical order too) were correct in the first place. It's discouraging. The deciding factor in my buying a computer with word processing capabilities was the flurry of programs promising to end forever the curse of Noah Webster. (He's the one who started it all, you know. He's the one who came along 198 years ago and gave us only one way to spell a word. The right way. His way.)

In my prepurchase research, I came across a bit of dictionary software that not only does more than any of the others I've read about but costs less. Far less, in fact. Word retails for $75. (Spellguard is $295. Others run in the $150-250 range.) "The first question people ask me," says the creator of Word, Wayne Holder, "is 'What's wrong with it? Why is it so cheap?' " Thus far I've found nothing "wrong," and a good deal right.

The dictionary in Word is massive, having more than 45,000 entries. (Other software seem to be in the 20,000-word range.) The dictionary is compressed, allowing that many words, plus all other programs and commands, to fit into less than 154K bytes of disk space. (The dictionary itself uses 136K bytes.)



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Noah Webster

Word does what all other "dictionary" programs do. Their functions include checking each text word against its dictionary spelling and listing words that don't match, indicating misspellings, typos, uncommon proper names, jargon, or technical terms. Then, after the option to edit the list, mismatched words are marked in the text for correction.

The latest edition of Word (version 2.0) uses a feature called REVIEW. As each of the mismatched words appears, with a single keystroke you can:

- mark the misspelled word in the text for later correction
- add the word, if correctly spelled, to the dictionary so that it will never again appear on a mismatched word list
- add the correctly spelled word to a special dictionary that will be checked only upon request, or
- delete the word from the mismatch list

What if you accidentally delete a word that should have been added to the dictionary or add a word to the dictionary that should have been marked as a misspelling? That's easy; REVIEW is very forgiving. Simply back up and reroute the word to its desired location. (If you have a version of Word prior to 2.0, Oasis Systems will update it for $10.)

To find the correct spellings for words that are misspelled, Word uses a program entitled LOOKUP. LOOKUP is a tool that, from my point of view, is worth far more than $75 all by itself. Simply type LOOKUP and the way you *think* the word should be spelled, and LOOKUP will, nine times out of ten, find the correct spelling.

I misspelled twelve words writing this

article, and LOOKUP found the acceptable-to-Mr.-Webster spelling for eleven of them. It does this, I'm told, by "correcting" the word in a great many ways (using the four most common mistakes in spelling), checking these "corrections" against the main dictionary, and listing the words that match. All this takes about ten seconds. If I were to have LOOKUP check *thier*, for example, it would list *their*, *thief*, and *tier*. I may be bad at spelling, but of the three, I can tell the word I'm looking for is *their*. (I renamed the LOOKUP.COM file L.COM on my personal version of Word. Now, rather than typing LOOKUP before each misspelled word, I need only type L. Similarly, I changed SPELL.COM to SP.COM and REVIEW.COM to R.COM.)

Homonyms, words pronounced the same but spelled differently, pose a problem to any spell-check program. Only the meaning of a sentence determines when *stationary* should be used instead of *stationery*, or *their* instead of *they're* or *there*.

Word offers a partial solution, however. The program has a file of 860 homonyms. First remove the homonyms you know how to use correctly. The ones that remain are potential troublemakers for you, and Word will, upon request, mark these words in the text for closer review.

Another fascinating feature of Word is FIND, indispensable to crossword puzzle fanatics who don't mind a little help and rhyme writers who welcome all the help they can get. Based on the number of letters known, with "?" or "*" representing the letters unknown, FIND will locate all the words that might fit the format you request. If, for example, you were doing a crossword puzzle and needed a four-letter word that ended in "Q," you would type FIND ???Q (each "?" represents one letter) and, in less than a minute, FIND would conclude that the word you're probably looking for is *Iraq*.

If you were writing an "Ode To My Computer" and were looking for a lyrical match for *terminal*, you would enter FIND *AL ("*" represents any number of letters), and all words ending in *al* would come flooding forth (as a poet might say). This would give a nearly endless list of words. To tighten the rhyme, you might want to remove just the first letter and enter "FIND *ERMINAL. This yields only one possibility, *germinal*. So you might want to loosen the rhyme a bit and leave off the first syllable, entering FIND *MINAL. This brings forth from the depths of iron oxide such gems as *criminal*, *nominal*, and *seminal*, among others.

Counting and Sorting

Three more great tools for the writer included in Word are WORDCOUNT (WC), WORD FREQUENCY (WORD FREQ), and DICTIONARY SORT (DICTSORT). It took WORDCOUNT about three seconds to count every word in this article. (Can you imagine how long it would have taken *me*?) However, there are only 566 unique words. That is, I used 566 words and by repeating some came up with a 1690-word article. [**Editor's Note:** all numbers refer to the original, unedited manuscript.] Which words were repeated and how many times each? That's where WORDFREQ comes in handy.

WORDFREQ tells how many times each word in the document was used and will list them either in descending order of usage or alphabetically. The top ten words in this article are: *the* (with a whopping 111 occurrences), *word* (with 53), *a* edged out *and* (with 46 and 45 respectively), *of* (39), *in* (37), *to* (35), *I* (29), *is* (27), and *that* (26). Of the 566 unique words, 346 of them were used only once. So I used 566 words, 346 only once, and repeated 220 of them as many as 111 times each. Now where else in the world could I come up with that information?

DICTSORT is a program that will alphabetize any group of words within seconds. If it puts the index of one book in order, it has paid for itself. DICTSORT is also great for mailing lists, record collections, or, if you're more like Daniel Webster than Noah Webster, it will put your list of "Alternative Spellings For Free Americans" in perfect order faster than you can say "Life, liberty, and the pursuit of happiness."

Word's major drawback is obvious: it needs a disk capacity of at least 154 K bytes, which a great many microcomputers do not yet have. (I am told a 20,000-word version is on the way and will fit single-density 5¼-inch systems.) Word is currently available on single-density 8-inch disks and double-density 5¼-inch disks. Word uses CP/M 1.4 or 2.2 and will work on Radio Shack Model II if it has been fitted with CP/M. Word is compatible with almost all CP/M-based word-processing and text-editing software.

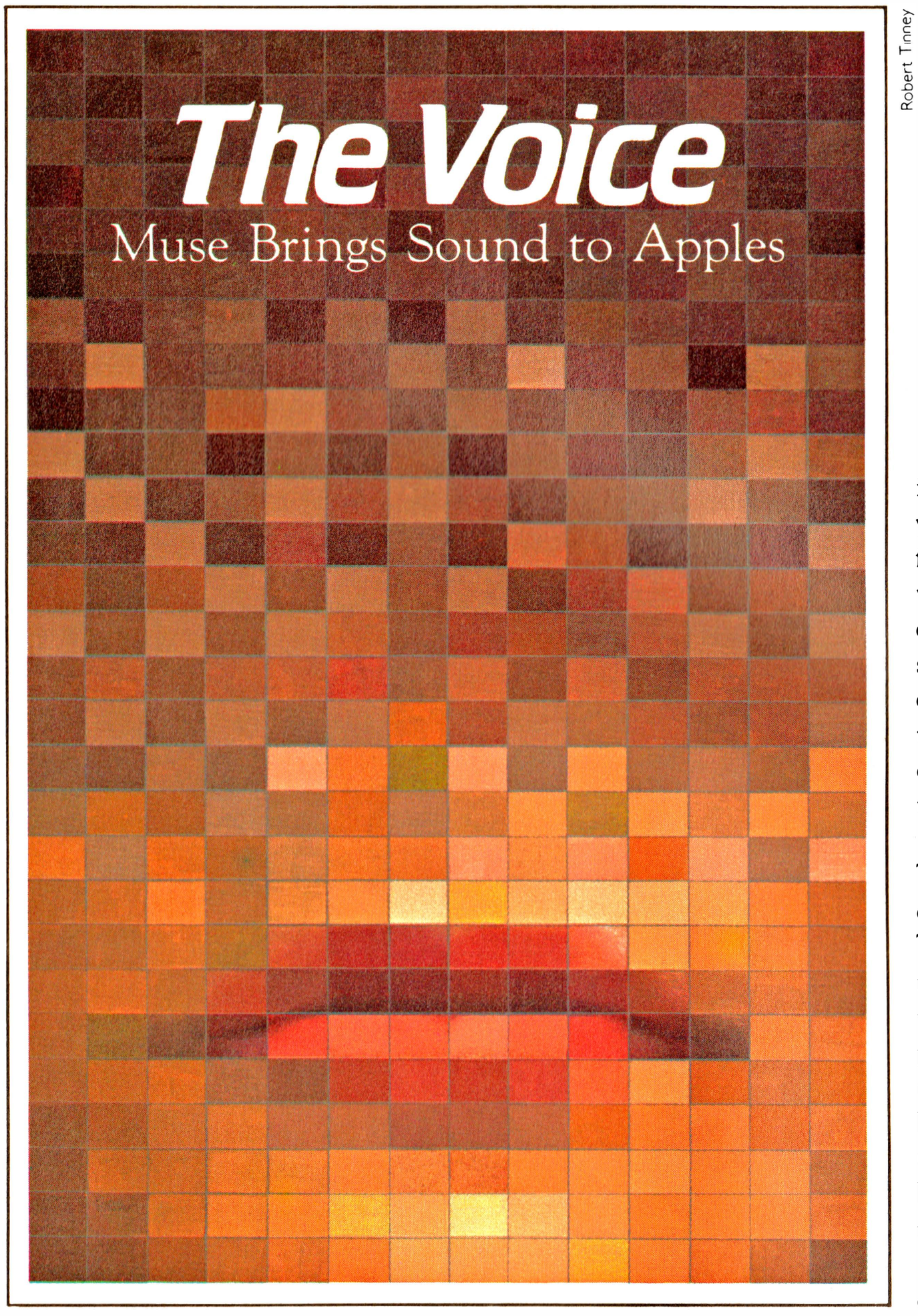
Its 42-page manual is clear, friendly, and to the point and includes all you'll need to know to be working Word within an hour. (Maybe less for you; I'm as bad at reading as I am at spelling.) I would heartily recommend *any* of the several programs contained in Word for $75. When they're all together, in one package, for that same price, well, it's one of the greatest software bargains around. □

At a Glance

Name: Word (version 2.0)
Type
Spelling correction and text analysis
Manufacturer
Oasis Systems
2765 Reynard Way
San Diego, CA 92103
Price
$75
Format
Floppy disk, 8-inch and 5¼-inch
Computer
CP/M-compatible systems with at least 154K bytes of disk storage
Documentation
42-page book
Audience
Anyone who uses a CP/M-based word processor.

Peter McWilliams is a Los Angeles-based writer whose credits include The Word Processor Book, *a short course in computer literacy.*

by Robert Swirsky



Robert Tinney

Remember insidious but soft-spoken HAL in the movie *2001*? Talking computers have captured the imaginations of moviemakers, science-fiction writers, and computer hobbyists for years. Now, new advances in speech-synthesis technology have brought voice systems for microcomputers into being *and* even into the price range of home-computer fans.

The Voice, created by Muse Software, stores and reproduces speech through a process called *digitization*—the representation of real-world phenomena (like sound) as a series of numbers. Other, more expensive systems recreate speech using prestored *phonemes*—the vowel and consonant sounds that are the building blocks of words.

The Voice lets you store, edit, and play back speech through the Apple cassette input and speaker output: you "hear" the sound through the cassette interface and "record" in a section of RAM (random-access memory). While the audio quality of The Voice isn't exactly hi-fi, it is quite understandable.

The beauty of The Voice is that it needs no additional hardware other than a 48K-byte Apple II, a disk drive, and a cassette recorder. Priced at $39.95, it could well be the least expensive way for Apple users to get started in computer-generated speech.

Using The Voice in BASIC programs is easy. After you've set up the program, use BASIC's familiar PRINT statement to activate the speech function. Given a word, the program then searches the computer's memory as well as the disk drives to see if the word is digitized on file. If the word is available in memory or on disk, you'll hear it spoken from the speaker; if not, you'll hear a beep. Because BASIC's PRINT statement is used to control the speech function, it's simple to incorporate The Voice into existing programs.

The main section of The Voice program is called the voice editor. The editor lets you record, save, and edit words, as well as add pauses before and after the word and chop off beginnings or ends. (Words often sound better if the endings are trimmed slightly.) Words can be input directly using a microphone and amplifier or prerecorded on tape and played back through the cassette input. An optional monitor feature lets you hear what's being played into the cassette jack.

Once a word is entered, it can be played back, changed in pitch, edited, or stored on disk. Words can be stored individually or as one large file, which allows you to load the entire vocabulary at once instead of a word at a time.

Also included with the program is a lively demonstration that explains different features of The Voice and gives

sample words and sentences.

The Voice comes with a 22-page instruction manual that is clear and easy to understand; it has detailed instructions, technical information, program examples, and a troubleshooting guide. Unfortunately, the brief section of the manual dealing with the theory of speech synthesis is not as effective as the rest of the manual.

Muse makes every effort to deter piracy. The Voice uses a modified disk operating system, which makes it difficult to back up the entire contents of the program disk. You can, however, copy your digitized vocabulary onto other disks. If the program disk should wear out, Muse will replace it for $10.

The Voice is an excellent example of how software can take the place of expensive hardware. It also has hundreds of uses for home entertainment and business. (I used the program to create a "talking calculator" that does the four basic math functions and "speaks" the answer.) Now you can give The Voice to your Apple. □

Robert Swirsky is currently working toward his B.S. in Computer Science at Hofstra University. His articles on computers and software have appeared in major publications.

At a Glance

Name: The Voice

Type
Digitized speech program

Manufacturer
Muse Software
330 North Charles St.
Baltimore, MD 21201
(301) 659-7212

Price
$39.95

Format
Floppy disk (DOS 3.2/3.3)

Computer
48K Apple II or II Plus

Requirements
At least one disk drive

Documentation
22-page booklet

Audience
Anyone who wants to experiment with computer-controlled digitized speech

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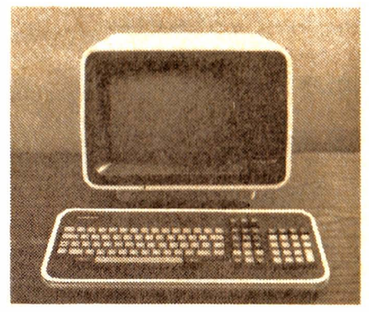

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The Human Dimension of the Microcomputer

by William Keough

The Microelectronics Revolution: The Complete Guide to the New Technology and Its Impact on Society edited by Tom Forester, The MIT Press, 1981, 589 pages, softcover $12.50, hardcover $25

The microelectronics industry has invaded almost every aspect of our lives in recent years. Along with the proliferation of this space-age technology comes a host of questions, not the least of which is "How far will we go with these latest wonders or how far will they go with us?" Our new electronic knowledge may seem like magic to some people, but it is a serious force to be reckoned with. Unlike Pandora, we must be ready to harness those forces unleashed, in this case by the invention of the microchip. The role the new technology will play in our lives depends simply on the ways we decide to use it. A quintessentially human vision of the new technology is at the heart of Tom Forester's wide-ranging anthology, *The Microelectronics Revolution*.

The book is a sourcebook, a kind of McGuffy's reader of the new technology's triumphs and problems. The anthology includes essays by such industry giants as Robert Noyes of Intel and sociologists like Daniel Bell of Harvard. Split into three sections, *The Microelectronics Revolution* begins with hardcore information on the new technology, the industry, and applications, while the bulk of the book is aimed at the impact of microcomputers on the work force, home, and business.

Having in my possession the rough technical knowledge of your average country chipmunk (even the other chipmunks think of me as a humanist), I appreciated the articles on silicon-chip miniaturization, production photos, cost-unit graphs, and illustrations of such processes as "the complete fabrication sequence for a two-level, *n*-channel polysilicongate MOS circuit element." The other chipmunks enjoyed my explanation of *that* over morning coffee.

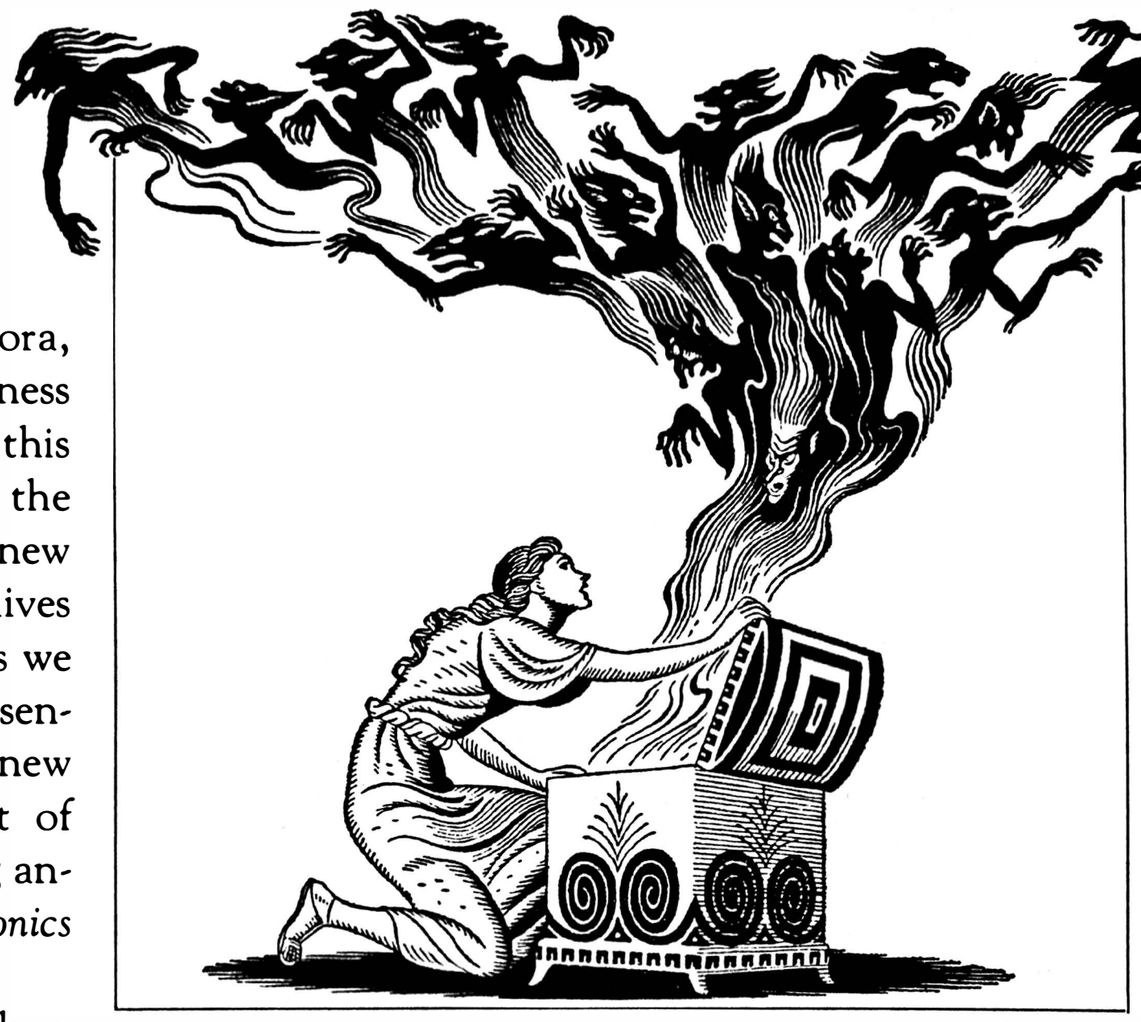

Illustration by Steele Savage from *Stories of the Gods and Heroes* by Sally Benson © 1940 The Dial Press.

The fact that Forester is English (also a former writer for *New Society Magazine*) may explain why he included so many labor-related essays in his tome. Confronting both actual and potential labor displacement problems arising from what's called (in a kind of reversion to zoo language) "labor shedding," the English seem to argue these matters out beforehand—though not, apparently, in all good humor. Chris Harmon of the Socialist Workers' Party of Britain, in an unintentionally amusing article on "How to Fight the New Technology," offers step-by-step obstructionist techniques for labor leaders threatened with personnel layoffs. Office workers are organizing and in France they have of course set up a distinguished committee.

Essays such as these are meant to give pause—though pause, particularly in the United States, is often not what anyone seems to want. In a world which seems choked by the idea of limits in capital expansion caused by population growth and resource depletion, the microelectronics industry looks like a good place to make a fast buck. Running throughout the book is a sometimes not-so-subtle listing of home products and business applications—digital watches, video games, banking systems, etc. Mister Chips is here to stay.

William Keough is a professor of English at Fitchburg State College in Massachusetts.

Optimists like Daniel Bell argue that microelectronics will make the world a better place to live because, in Bell's words, "it opens the way to alternative modes of achieving individuality and variety with a vastly increased output of goods." Beneath the jargon lies a true believer.

Skeptics like Joseph Weizenbaum, Professor of Computer Science at MIT, take the more jaundiced view that home-computer applications will come but that they won't necessarily make anyone any happier. Likening computers to television, he observes:

> "This exquisitely refined combination of some of the species' highest intellectual achievements, what does it deliver to the masses? An occasional gem buried in the immense avalanche of the ordure of everything that is most banal and insipid or pathological in our civilization."

Of course, Weizenbaum, himself, might be invited to a local watering hole where oldtimers sip their boilermakers and watch "Candlepin Bowling" while their sons play Space Invaders behind them.

The issue of change runs through the book and, certainly, changes within the microelectronics industry have been remarkable. As C. Lester Hogan of Fairchild Camera and Instrument observed when he drew a $20 microprocessor from his pocket and threw it out to his audience, "That's $18 million worth of computer power—or it was twenty years ago." Showy, but impressive.

Changes in humans are, as usual, less impressive. One cannot ignore the appeal of such scientists as A. E. Cawkell for a new breed of "sociotechnologists" capable of bridging the gap from the new machines to human applications.

But rapid change will prove to be one of *The Microelectronics Revolution's* major failings. In an industry which prides itself on daily discoveries and two-year generations, the book, by definition, is an incomplete guide despite its impressive subtitle. Rapid change means rapid obsolescence.

Forester's anthology tends to claim too much, both for the industry and for itself. It is, perhaps, the mark of all new technologies to claim too much simply because hype is so good for business. (Consider, for instance, the recent rustle of drapery in academe concerning the embryonic biogenetic industry following the discovery of DNA.) Like the industrial and computer revolutions before it, the microelectronics revolution and its promise of a new world may be more illusory than real. Some conversions, some transformations are genuine, but it's still not clear how your typical fifteen-year-old with his hand-held calculator has been revolutionized.

Forester's anthology is a useful text on the state of the art and the nature of the concern. It should be adopted at many colleges around the country. But its popular appeal is that it's an attractive mixed bag—the dabbler or sophisticate should find it a worthwhile addition to the bookshelf.

As for myself, I'm haunted by the thought of a Pandora's box of silicon chips let loose upon the world. Tell me, Tom Forester, what doth it profit a man to gather so many billions of microseconds and lose his immortal soul?

A Young Person's Guide to Computers

Paul M. Danzer
Scelbi Publications, 1981
101 pages, softcover $7.95
Reviewed by Susan Ferber

With computers becoming more common in schools it makes sense to write a book that introduces children to computers. No easy task, but that's what Paul Danzer has done in *A Young Person's Guide to Computers*. According to Danzer, "Kids give you ten seconds to come across with the message or they count you out." Keeping this firmly in mind, Danzer has written a computer primer that will hold even

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the most active child's rapt attention.

The history and a definition of computers are discussed in several brief chapters, but the topics covered in most detail are programming and flowchart design. A step-by-step approach leads the young reader through the programming process, with several practice programs included for review.

The one drawback to *A Young Person's Guide* is its lack of color. While the drawings and diagrams are imaginative and well executed, their impact is less effective in black and white. Danzer overlooked the important role colors play in holding a child's attention. This is, however, a small price to pay for informative writing.

If your child knows little or nothing about computers, *A Young Person's Guide to Computers* is the perfect "first" book. The writing is clear and concise and the author explains computers in logical, easy-to-understand terms without condescending to the reader. In fact, you'll probably enjoy reading the book as much as your child does.

Microcomputer Buyer's Guide

Tony Webster
Hayden Book Company, 1981
326 pages, softcover $25
Reviewed by George Stewart

It's rare to find a book that achieves exactly what it promises to do—especially when the task is complicated or vast in scope. This is especially true of books "explaining" popular computers: often the book's title and promotion seem to have been chosen to improve sales without respect to the book's actual contents. Many "guides" to small computers are nothing more than revisions of the mainframe computer texts of previous decades, and no help to a microcomputer buyer.

Webster's *Microcomputer Buyer's Guide* is exactly what it purports to be—a practical look at small computers, written for the prospective buyer. The book gives new meaning to the phrase, "according to Webster."

The *Guide* is divided into four parts: Part I gives the basic definitions and background you need to evaluate specific products; Part II discusses the major suppliers of microcomputer software; Part III is a detailed description of small computer software and hardware, arranged alphabetically by manufacturer for easy reference (of course, this information cannot be entirely up to date; for example, IBM's Personal Computer was announced after publication of the *Guide*); Part IV is a listing of printers, displays, and printing terminals.

Descriptions and definitions of hardware components are presented early in Part I, with special attention given to the questions a buyer should ask. A discussion on software is written for the buyer and various questions are answered, including what kinds of programs are available in the various applications (industrial, scientific, commercial, hobbyist/home computer, educational). Knowing what *should* be available will help you evaluate what *is* available on the particular computer you're interested in. The book also provides a summary of standard BASIC features to help you check out the BASIC that's offered on a particular model.

The next six chapters of Part I present useful information for specific interests:

- A microcomputer market analysis, written for administrators, managers, and investors
- Selection guidelines for using microcomputers in commercial settings
- Word processing in the office—definitions, cost/benefit analyses, features to look for
- Future trends in microcomputers
- Communications and networking—a technical treatment, with definitions of the major buzzwords (types of network, nodes, timesharing, information utilities, asynchronous and synchronous communications, full- and half-duplex transmissions)
- Education—methods of computer-assisted instruction (CAI), cost/benefit analyses, typical systems for the classroom; unfortunately, omits any discussion of the more creative uses of

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computers in education (programming with Logo, computer literacy training, etc.)

Part II discusses software products available from such independent sources as Digital Research and Microsoft. Special chapters are devoted to software products for Apple, TRS-80, Commodore, Z80-based and 68*xx*-based computers.

The heart of the *Guide*, Part III, consists of detailed descriptions of products from 54 different manufacturers. Each product description includes:

- An overview
- Detailed description of the basic system
- Description of peripherals available from the manufacturer
- Manufacturer's software
- Suggested retail prices for most products discussed
- Head office addresses

Because of the information contained in this chapter alone, the *Guide* should earn itself a place in the daily reference shelves of computer writers, salespersons, and others whose work is related to computers.

The final pages are devoted to a brief but useful look at printers, displays, and printing terminals. Unfortunately, prices are not shown in this section, probably because the list price often has little relation to the price at the store level.

In summary, the *Microcomputer Buyer's Guide* offers the information you need to make an intelligent purchase. However, don't look to it for recommendations on specific products, or for comparisons between products. That job is left up to the reader.

The Computers Are Coming

Irv Brechner
Irv Brechner Publisher, 1981, 92 pages, softcover $4.95
Reviewed by Susan Ferber

How much would you pay for a computer that rounds up cattle rustlers, analyzes your psychological hangups, and tells you when it's safe to have sex? But wait! Before you answer, you also get this heavy-duty electronic window washer! Now how much would you pay? This all-too-familiar sales pitch, usually a 60-second ad on TV, is the approach Irv Brechner takes in *The Computers Are Coming*.

Brechner (an advertising executive) spends 90 pages extolling the wonders of the personal computer without considering the questions Which computer is right for me? What programs will suit my needs? How much should I spend? Where is the best place to find the one I want?

Instead, Brechner presents the reader with chapter upon chapter of typographical errors, misleading information, and questionable grammar. And while he claims to be writing for the layperson, his book contains little that increases one's knowledge of computers. Chapter titles such as "Let's Go Down to the Corner Store," "Now It's Time For Fun and Games!" and "Try It....You'll Like It" indicate what to expect. Sadly, these expectations are fulfilled.

Exploring With Computers

Gary G. Bitter
Julian Messner, 1981
64 pages, hardcover, $7.59
Reviewed by Heidi Copeland

While computers are often depicted as heroes or villains that can think, talk, walk, and save or destroy worlds, the truth is that they are only tools for human use. So writes Gary G. Bitter in his fun-filled primer on computers.

A professor of education at Arizona State University, Bitter has written a series of children's books on topics such as solar energy, the metric system, and pocket calculators. But *Exploring With Computers* is more than just a kid's book; it is also an unintimidating introduction to computers for adults. In fact, some would-be authors of computer manuals should take a lesson from the professor and learn how to present computers in the simplest manner possible. □

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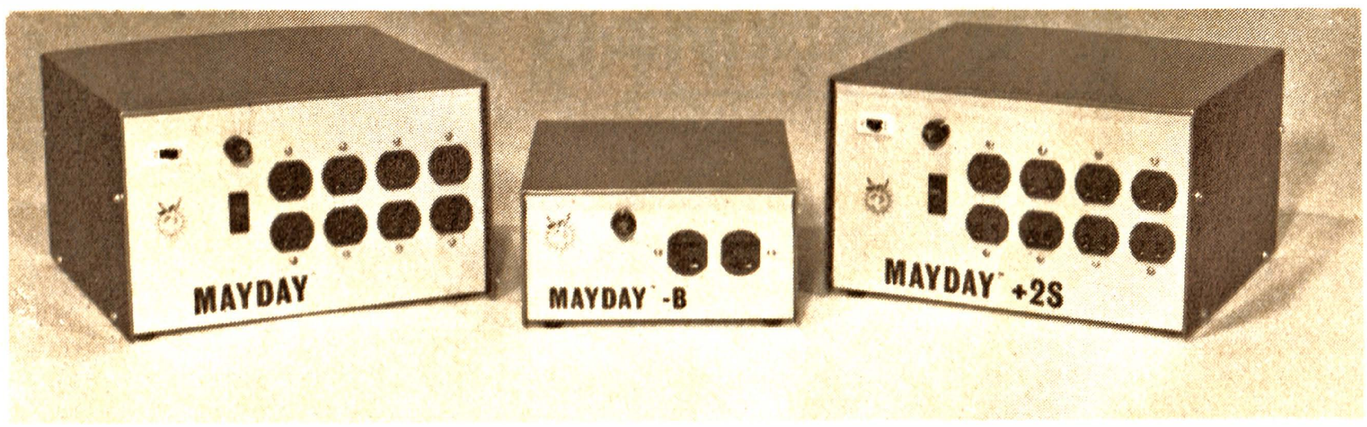

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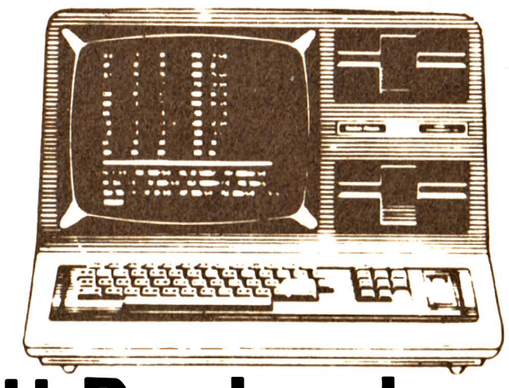

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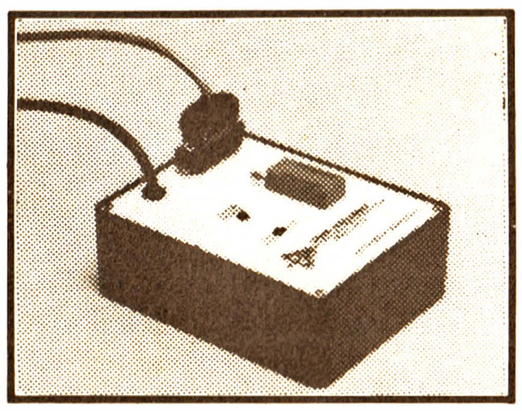

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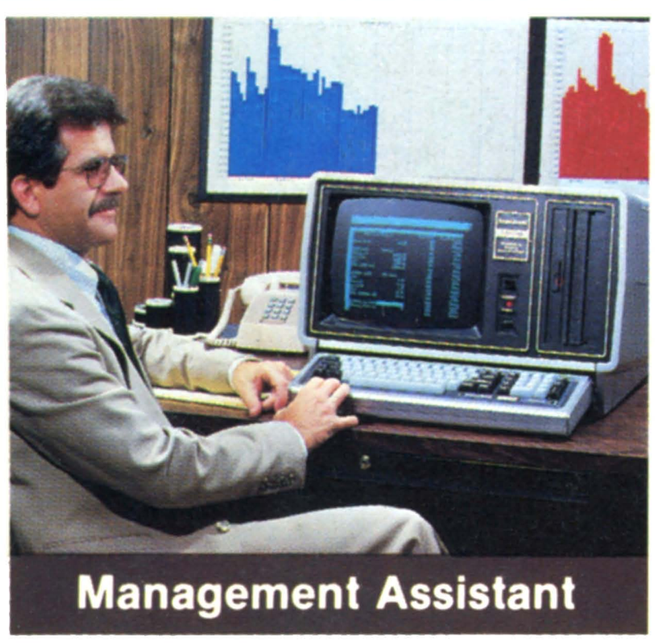
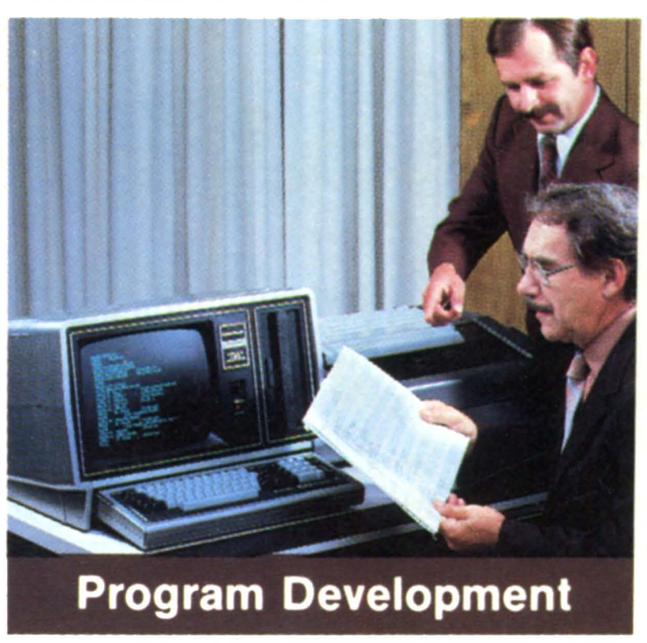
Get Radio Shack's TRS-80 Model II *Multi-Purpose* Workstation.

Professional Applications



Management Assistant



Program Development

Bi-Sync Communications

Radio Shack's top-of-the-line TRS-80® Model II is more than a computer. It's a versatile, stand-alone system that's the heart of a multi-purpose workstation. You can use the Model II by itself, or with a printer and other peripherals to accomplish a wide variety of tasks.

Professional Business Applications. A complete Model II business system has the storage capacity and expandability to streamline your accounting, inventory control, order entry, and many other tasks. We also have ready-to-run software for legal, medical, and other specialized applications. Best of all, every Radio Shack software program can be put to work without formal operator training, thanks to our easy-to-understand documentation.

Management Assistant. The TRS-80 Model II is also for managers. It can help with planning and modeling, word processing, electronic filing, statistical analysis, and much more. You can do jobs that are too "hot" to wait for shared computer time or too small for cost-effective handling by your company's mainframe. Putting a Model II by your desk is one of the easiest ways to boost your personal productivity.

Program Development. To meet your specific requirements, Radio Shack offers you a choice of Model II programming languages. We have BASIC interpreter and compiler, COBOL, FORTRAN and ASSEMBLER. In addition, Model II's sophisticated Disk Operating System has many powerful features, yet it's easy to use. It gives you a full set of library commands, utility programs and useful system routines that can be called directly by user programs.

Bi-Sync Communications. The TRS-80 Model II is ideal for use in existing data processing operations because it offers the versatility that a mere terminal lacks. With our bi-sync communications packages, Model II provides low-cost access to large mainframe computers. With our exclusive TRS-80 VIDEOTEX software, you can also access data base networks and information services.

It's Affordable. Model II systems start as low as $3899. Let us show you what the TRS-80 Model II can do for you! Drop by a Radio Shack Computer Center or the expanded computer department of selected Radio Shack stores and dealers nationwide for a personal demonstration.

Radio Shack®

The biggest name in little computers™

A DIVISION OF TANDY CORPORATION

Retail prices may vary at individual stores and dealers.
Optional-extra equipment required for some applications.

Tell me more! Send me a free TRS-80 Computer Catalog.

Mail To: Radio Shack, Dept. 82-A-49
1300 One Tandy Center, Fort Worth, Texas 76102

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